POWER SECTOR REFORMS AND THE POOR:

CASE STUDY OF ZAMBIA

Mirriam Simasiku (SMSMIR001)

A minor dissertation submitted in partial fulfillment of the

requirements for the award

Degree of Master of Applied Science (Energy Studies)

Energy Research Center

Faculty of Engineering and the Built Environment

University of Cape Town

Declaration

This work has not been previously submitted in whole, or in part, for the award of any degree. It is my own work. Each significant contribution to, and quotation in, this dissertation from the work, or works, of other people has been attributed, and has been cited and referenced.

SIGNATURE Signed by candidate DATE: 26 05 2004

ABSTRACT

Power sector reforms around the world have been driven by various factors ranging from economic and financial to technological reasons. The reforms in the power sector are frequently undertaken under conditionality agreements linked to broader macro economic reforms.

The main objective of this thesis is to find out whether power sector reforms advance social benefits to the poor, specifically increase their affordable access and use of electricity in Zambia.

The rationale behind power sector reforms in Zambia include the increase of access to electricity by the majority of the Zambian population through expansion of the national electricity network to cover areas that have production potential. The promotion of private sector participation in the electricity industry by ensuring that market rules are attractive to private investors is another objective of reforms. The reforms also aim to improve efficiency in the electricity industry.

To achieve the rationale of power sector reforms, the government's focus is on macro electrification projects. These electrification projects exclude poor household electrification owing to its unprofitable nature. Furthermore, the expected economic benefits arising from the macro electrification projects could result in further marginalization of poor household electrification. In short, the proposed approach to restructure the electricity industry in Zambia does not contain specific initiatives for increasing affordable access to electricity by the poor households.

This thesis draws out the point that without considerable attention to affordable access to electricity by the poor at the inception of the reforms, addressing them at a later stage could difficult. To be effective, social concerns need to be included into the reform design early and backed by strong political commitment.

ACKNOWLEDGEMENTS

In my quest for the voices from the poor in Power Sector Reforms, it is great joy to acknowledge my indebtedness to all these wonderful people who contributed so unselfishly.

Firstly, I would like to thank AFREPREN (African Energy Policy Research Network) for their financial support for this study, particularly Mr. Stephen Karekezi, the Director of the institution.

I also extend my gratitude to the University of Cape Town, professors and staff of the Energy and Development Research Centre (EDRC).

In particular, Prof. Gisela Prasad, my supervisor, who gave me the tools with which to fight my academic battles, I wish to express my sincere gratitude and most heartfelt appreciation. Her patience, guidance and encouragement have been very stimulating. Thank you for having trust in my ability.

My heartfelt gratitude goes to Prof. Ogunlade Davidson for his sincere concern.

My deepest gratitude goes to my husband, Hyangmo Kim, for his constant support and encouragement. Furthermore, I express my sincere thanks to my parents and my family in Korea, Spain, England and Zambia, who taught me the value of academic life to complete this study. My heartfelt gratitude also goes to my friends for their constant encouragement. Finally, to my son, Mwilima Yesoo Kim, who mentally and emotionally gave me pure love and support throughout this study.

TABLE OF CONTENTS

1. INTRODUCTION

1.1 Purpose of the study

The main objective of this thesis is to find out whether power sector reforms advance social benefits to the poor, specifically increase their affordable access to and use of electricity in Zambia.

The population of Zambia was 10,172,000 in 2000 and 73% of the population lived below the poverty line. The poverty line was determined by the food basket approach, which calculates the cost of acquiring basic food items that provide the basic calorific requirements for an individual or household. In addition, 63% (6,367,000) of the total population lived in rural areas, compared with only 37% (3,805,000) in urban areas (Table 1.1). In general, the percentage of the poor in rural areas was much higher 83% than in urban areas 56% (CSO, 2000:115).

Table 1.1: Incidence of poverty by stratum in Zambia

	Below poverty line %	Above poverty line %	Total %	Total number of persons/%
All Zambia	**73**	**27**	**100**	**10,172,000/100**
Rural	**83**	**17**	**100**	**6,367,000/63**
Urban	**56**	**44**	**100**	**3,805,000/37**

(Source: CSO, 2000:115)

In 1994 the Zambian government formulated the National Energy Policy (NEP) with the overall goal of increasing the accessibility to electricity and developing the most cost effective sites for the domestic and export market (ERB, 2002: 2). The NEP sets a number of policy measures which include the restructuring of the electricity industry,

improving access to electricity, promoting electrification of productive areas and social institutions and developing hydropower potential. To achieve these objectives the government's main strategy is to open up the power industry to the private sector abolishing the statutory monopoly of the state owned utility, the Zambia Electricity Supply Corporation (ZESCO).

The electrification levels in Zambia are low, less than 20% of the total population have access to electricity and only 2% in the rural areas, where the majority of the population live and where 83% of the poor reside (CSO, 2000: 115). Despite the fact that the national grid or isolated diesel generated electricity reach almost all the 72 administrative districts in the country, only a few people living in these areas have access to electricity. This is mainly because the grid does not extend beyond the main district centers and also the people's inability to afford the initial connection fees and inside wiring costs.

Rural electrification is an important agenda because it is expected to stimulate economic productivity and improve standard of living. First time access to electricity transforms daily experiences of poor households not only in terms of lower energy costs and more convenient services but also in expanding opportunity for entertainment and use of a range of new productive appliances including production tools (Eberhard and van Horen, 1995:206).

However, since rural areas are characterized by low economic activity, expansion of the grid to these areas is perceived to be commercially unviable and hence unattractive to private investment. Rural electrification requires proper balance between the provision of affordable service to the majority of low-income households and stimulation of economic activity to create industrial and commercial demand for

electricity thereby creating employment and improving the income levels of rural households. This generally implies the need for subsidies on capital investment and rural electricity tariffs, making rural electrification the responsibility of the government because of its social developmental nature (ERB, 2002:27).

In Zambia, rural electrification is funded through the Rural Electrification Fund (REF) created in 1995 by the government. The Rural Electrification Fund Committee (REFC) under the Ministry of Energy and Water Development (MEWD) administers the REF. Electricity consumers are charged an excise duty of 5% of the value of the electricity bill. This duty is collected by the Zambia Revenue Authority (ZRA) and deposited in the national treasury. The Ministry of Finance and National Planning (MFNP) transfers these funds to MEWD for rural electrification. The REFC appraises and decides which projects to finance and then disburses the funds to ZESCO, the sole government agency implementing this task.

Since its institution the REF has not achieved its objectives because the release of funds from the national treasury is delayed and only a limited amount is released as the MFNP diverts funds to more urgent and competing needs. The REFC does not have comprehensive guidelines to guide the selection of projects and utilization of funds (Jain, 2003a:8).

These forgoing issues therefore make rural electrification, which is basically electrification for the poor a very important aspect of power sector restructuring in Zambia.

1.2 Scope and objective

This thesis is limited to Zambia, which is planning to restructure the vertically

integrated state owned power utility, ZESCO. This study though draws on experiences from the international scene as well as the Sub-Saharan African experiences.

The major objective of this thesis is to find out whether the approach of power sector reforms in Zambia will advance social benefits to the poor. Social benefits in this case focus on the increase in access to affordable electricity by the poor households in Zambia.

1.3 Limitations of the study

The analysis of this study is mostly based on literature review. This therefore raises some bias depending on the source of literature reviewed and the authors' viewpoints. The availability and form of data collected in Zambia depended much on what could be availed at the time of collection. Therefore, this thesis does not cover the possible changes in the data from the time when the data was collected.

Some information collected was based on semi-structured interviews, which were not recorded, hence posing a risk that some mistakes were made when taking notes. The notes however were counter checked at the end of each interview and where clarification was needed; interviewees were contacted again.

1.4 Definition of main terms

The following terms are defined within the context in which the study was conducted in Zambia and hence limited to this thesis.

- **Poor:** the poor are defined on the basis of the total expenditure accruing to the household in which they are members. The Food Basket Approach that calculates the cost of aquiring basic food items that provide basic calorific value for an individual or houehold was used in this study as provided by the national statistics office (CSO, 2000:112).

- **Power sector reforms:** this refers to the approach power sector reforms are taking in Zambia since their inception in 1994 when the National Energy Policy (NEP) was formulated. The approach has had and continues to have a significant effect on important social concerns such as affordable access to electricity.

- **Rural electrification:** this refers to electrification of poor households as the majority of poor, 83% of the country live in rural areas or areas surrounding urban areas usually with very limited access to electricity. The term rural electrification is therefore used interchangeably with poor household electrification.

1.5 Methodology

The main method employed in this study was literature review and semi structured interviews.

- **Literature reviewed**

The literature reviewed was collected from various energy institutions in Zambia as well as the statistics office. The literature collected included reports, papers,

newsletters and brochures. Apart from the information collected from energy institutions in Zambia, other sources included the Energy Development and Research Centre (EDRC) reports, African Energy and Policy Research Network (AFREPREN) documents, Energy Policy Journals, and World Bank Reports from the Internet.

- **Semi structured interview**

During the process of collecting literature for review from various institutions in Zambia, some semi-structured interviews were conducted. The relevant officials from the institutions interviewed are listed in the List of Interviews. The basic questionnaire for the interviews is also given.

Not all the questions were answered, partly because information was lacking and in some cases sensitive to the institutions involved. The government institutions such as Energy Regulation Board (ERB), Department of Energy (DoE) and Office for Promoting Private Power Investment (OPPPI) were very open and responded positively to most parts of the questionnaire.

- **Socio-economic analysis**

An end user survey was not carried out to assess the impacts of the current electrification program on poor households. The Central Statistics Office (CSO) reports were purchased for this purpose. The reports provided results of the Living Condition Monitoring Survey (LCMS) conducted in 1998. Two types of questionnaires were used to collect data for the surveys. A questionnaire was used to obtain information on the household and each member of the household. The

topics covered in the LCMS included the following: demographic characteristics of the population, economic activities, income, access to various facilities and infrastructure, expenditure, and poverty (CSO, 2000:7).

1.6 Contents of the thesis

This thesis starts off by giving the experiences from other countries that have successfully achieved high levels of electrification without privatizing the national utilities (Chapter 2). The chapter also describes the impact of power sector reforms on the poor in some Sub-Saharan countries. A brief overview of the Zambian energy sector is given in this chapter.

Chapter 3 focuses on the electrification programs in Zambia and their impacts on the access to electricity by poor households.

Chapter 4 discusses the issue of the rationale behind the Zambian power sector reform and any institutional implications. The National Energy Policy is outlined as well as its policy implications in the power sector reforms.

Chapter 5 gives an overview of the poverty reduction strategies in the energy sector and the budget allocation to the energy sector.

Chapter 6 discusses the findings of the study on the impacts of the power sector reforms on the poor households access to energy.

Chapter 7 concludes and gives recommendations of the study.

2. LITERATURE REVIEW

2.1 Challenges of power sector reforms on the poor in Africa

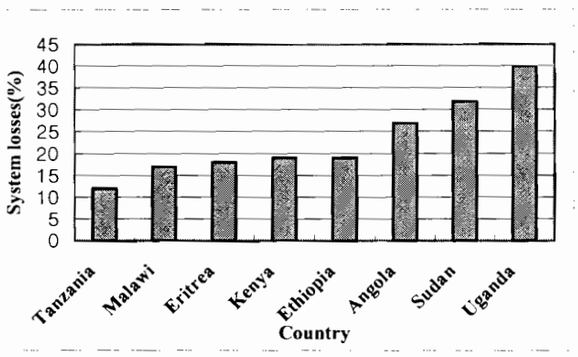
Over the past decade the power sector in many African countries has been undergoing major reforms that have led to significant withdrawal of the state from the electricity industry. Karekezi and Kimani (2002), giving an overview of the African power sector, stated that despite a decade of reform, the electricity industry in Sub-Saharan Africa is still performing poorly as seen in the failure to provide electricity to the vast majority of the population (642 million in 1999: World Bank, 2001). The electrification rate currently stands at 23% (IEA, 2002:16; Karekezi and Kimani, 2002:923). Of specific concern is the continued absence of electricity services for the poor. Household electrification is low especially in rural areas. Key challenges that reforms face in advancing the interest of the poor in a reformed electricity industry include the following:

- Sustained improvement of the technical and financial performance of the electricity industry.

Instead of only focusing on the addition of new capacity in the electricity supply industry reforms should also primarily address the challenges that still face the transmission and distribution of electricity in the region. The prime response of African governments has been to secure an increase in the supply of energy. But it has become clear now that the necessary increase in supply will not in itself ensure the provision of adequate energy services. How appropriate the existing electricity utilities and institutions are delivering the services still remains a major challenge (AFREPREN, 1996:1). For instance the electricity supply industry in Africa is

characterized by high system losses as high as 30% when compared with the international target of 10 –12% (Figure 2.1).

Figure 2.1: System losses in selected African countries in 1999



Source: (Karekezi and Kimani, 2002:928)

- Rapid expansion of electrification.

With the exception of a few countries such as Mauritius, South Africa and Ghana most countries in Sub-Sahara have electrification levels well below 50%. The heavy emphasis on attracting Independent Power Producers (IPPs) that address generation and profitability have relegated expanded electrification of the poor to the bottom of the priority list. IPPs in India and Indonesia locked these countries into large generation plants. The electricity utilities undermined efforts at energy efficiency along the transmission and distribution ends. They committed themselves to buying electricity from numerous IPPs at uncompetitive prices (WRI, 2002:6).

Rural electrification programs have failed because of poor billing and revenue collection leading to non remittance of rural electrification levies and also due to reallocation of the remitted funds to other uses (Karekezi and Kimani, 2002:932). In Zambia for instance the remittance of the levy of 5% on all electricity bills for

rural electrification has failed to take place. This is because the electrification levy is channeled through the bureaucratic mainline government ministry, whose main concern is on other development projects (Mbewe, 2001). In Kenya's case, the levy is used by the utility to implement very high cost rural electrification projects that are unlikely to make major financial returns to the utility (Karekezi and Kimani, 2002:932).

- The issue of tariffs with regard to the poor.

Most subsidies in the past have benefited the rich in society since the levels of electrification are very low and only those who can afford the connection fee have access to the grid (Kyokutamba 2001; Karekezi and Kimani, 2002: 932). This can be demonstrated by comparing two countries, Uganda and South Africa, with similar poverty levels in percentage terms (55%) but different electrification levels. In Uganda, the electrification level is 5% and at this figure none or very few of the poor are likely to be connected to the grid (Kyokutamba, 2001; Engurait, 2001). Whereas in South Africa with electrification levels at 70%, close to half of the poor are also connected to the grid (NER, 2001). Therefore, in the case of Uganda as in most other Sub-Saharan countries, the electricity subsidies would benefit the non-poor; and in South Africa the removal of subsidies would impact negatively on the poor.

- The need for increased balanced local participation in the power sector.

Without significant local investment, the entire electricity industry would be handed over entirely to non-national operators whereas with local participation is

the snare of political-connected rent seeking class that has been largely responsible for the poor performance of state-owned power utilities.

When the electricity industry is handed over entirely to non-national operators such as multinational private companies, the developmental goals of the host country are substituted with interests of the shareholders of these companies. The primary objective of such companies is realizing profits within the shortest time. The framework of obstacles to offer guarantees on the investment and on profit repatriation therefore rests on the host country (Pineau 2002:1009).

The problem of political-connected rent seeking class for poor performance of state owned utilities is demonstrated through the case of the Zimbabwe Electricity Supply Authority (ZESA). The performance of ZESA reflects the performance of the Minister of Energy in charge. For instance, up to 1992 the Minister did not approve proposals to review tariffs, because for political reasons he wanted both the Board and the Chief Executive to resign (Mangwengwende, 2002:951). After a cumulative increase in inflation of 98%, without tariff reviews he only allowed a 21.7% increase in 1991. He succeeded in getting rid of the Board and Chief Executive and appointing his own Board. The result of the Minister's interference was continuous financial losses to ZESA (Mangwengwende, 2002:951).

2.2 Impact of reforms on affordable access to electricity by the poor

In part, power sector reforms are aimed at transforming the power utilities from social welfare institutions into profit making commercial utilities. Electricity reforms are usually associated with pressures to limit subsidies and enhance tariff collection. Large-scale projects, with long-term social objectives are difficult to price and more

risky. Developing countries use Long Run Marginal Costs (LRMC), which are based on such long-term social objectives in achieving their multidimensional goals of the electricity sector, which include social development goals such as the support of subsidies for the low-income groups. The one-dimensional goal of private companies is profit (Pineau 2002). Due to the multifaceted nature of social welfare needs, profit alone is not a sufficient motive for expanding access to relatively unprofitable poor customers, whether in urban or rural areas. Such changes, that is, the removal of subsidies and increase in tariffs could most likely result in the better financial performance of the electricity sector but the resultant tariff increases could cause social hardships and spur political opposition (WRI, 2002: 3). It is unavoidable for power sector reforms to take place without increase in tariffs. This is because tariff levels need to be increased, given the significance of the following three goals in power sector reforms:

- To recover the cost of electricity generation, transmission and distribution
- To fairly and equitably spread the above costs to consumers based on the true cost of service delivery, consumption levels and patterns
- To promote the efficient use of electricity

In many instances, however, an increase in tariffs has led to protests for the utility to reverse the increases. At government's order, the utilities have reversed these increases in tariffs at the expense of the utilities incurring the losses (Karekezi and Kimani, 2002:932). Some of the dramatic cost reflective tariff reviews have led to riots, such as in Ghana and protracted political debates in Uganda where as in Kenya the industrial and commercial sectors claim to have been partially crippled by tariff increases contributing to closure and relocation of some industries (Karekezi and Kimani,

2002:932).

In Argentina power reforms were intended to reduce governments role in providing key services including electricity as part of the broader macroeconomic reforms supported by multilateral agencies such as the World Bank in the late 1980s. The power sector reforms led to improved quality of services in urban areas. The incentives to increase expansion of electricity to isolated rural populations were not provided. This resulted in high tariffs placing a heavy burden on low-income consumers in accessing electricity (WRI, 2002:2).

The Canadian experience of Quebec indicates how private companies can exploit the consumers through market power. In the beginning of the 20th century in Quebec, private companies were the first to exploit the electricity industry's hydro resources and raised the electricity tariffs to almost twice what the neighboring province Ontario public-owned utility under similar conditions was providing. In the 1960s the government nationalized the Quebec electricity sector to eliminate territorial tariffs and this resulted in economic development. This is because the government-owned utility, Hydro-Quebec, delivered electricity at one of the lowest international rates. This paved way for rapid industrial development and the utility is today among the biggest North American electricity companies (Pineau, 2002: 1007).

This experience shows that the state had to be actively involved in the electricity sector to meet the economic development goals. These goals cannot be entirely left to the private sector, which may have conflicting goals.

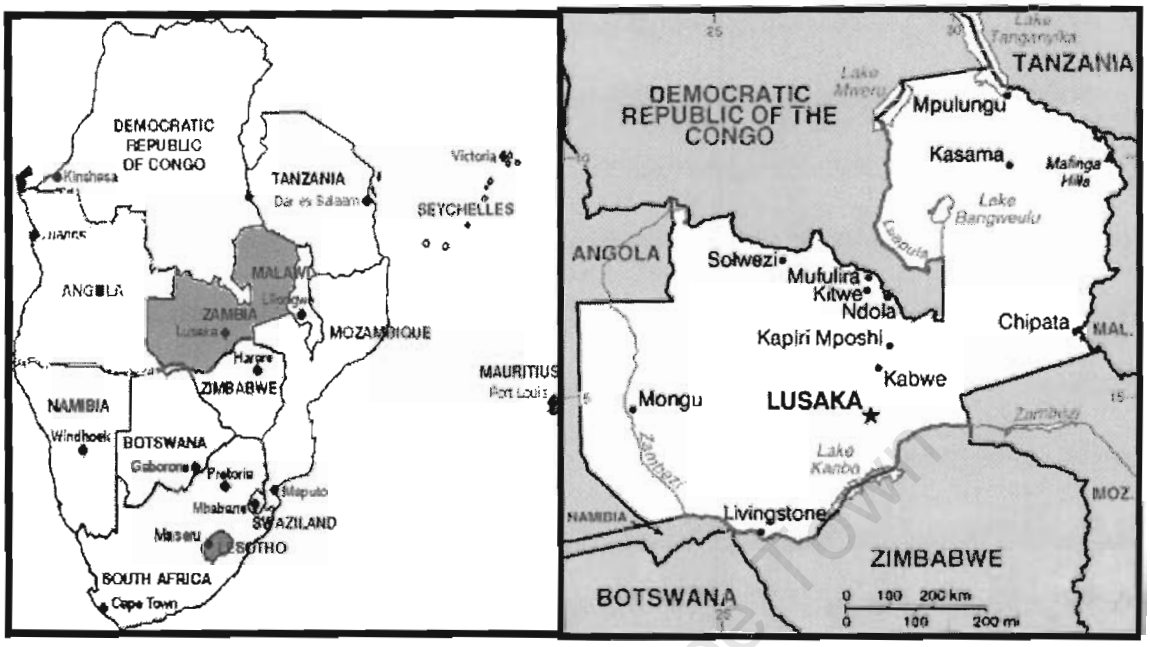
Another example of active state involvement is the case of South Korea whose principle domestic energy until 1965 was wood. It shows that public monopolies in developing countries can be able to oversee the complete development of the electricity sector producing high levels of access to affordable electricity by the majority. The country's' installed capacity went from 794MW to 13 115MW over a period of 18 years, a 17% annual increase. Instead of relying on private utilities to develop the sector, the Korean Government borrowed from the international market and invested in the national vertically integrated monopoly Korean Electric Power (KEPCO). Since then the country has experienced rapid economic growth accompanied by a similar increase in per capita electricity consumption (Pineau, 2002: 1008).

2.3 Zambia background information

2.3.1 Geographical background

Zambia is a landlocked country, lying between latitudes 8 and 18 degrees South and longitudes 22 and 34 degrees East. The country shares a boundary with eight other countries: Democratic Republic of Congo and Tanzania in the north; Malawi and Mozambique in the east; Zimbabwe and Botswana in the south; Namibia in the southwest; and, Angola in the west (ECZ, 2001:1) (Figure 2.2).

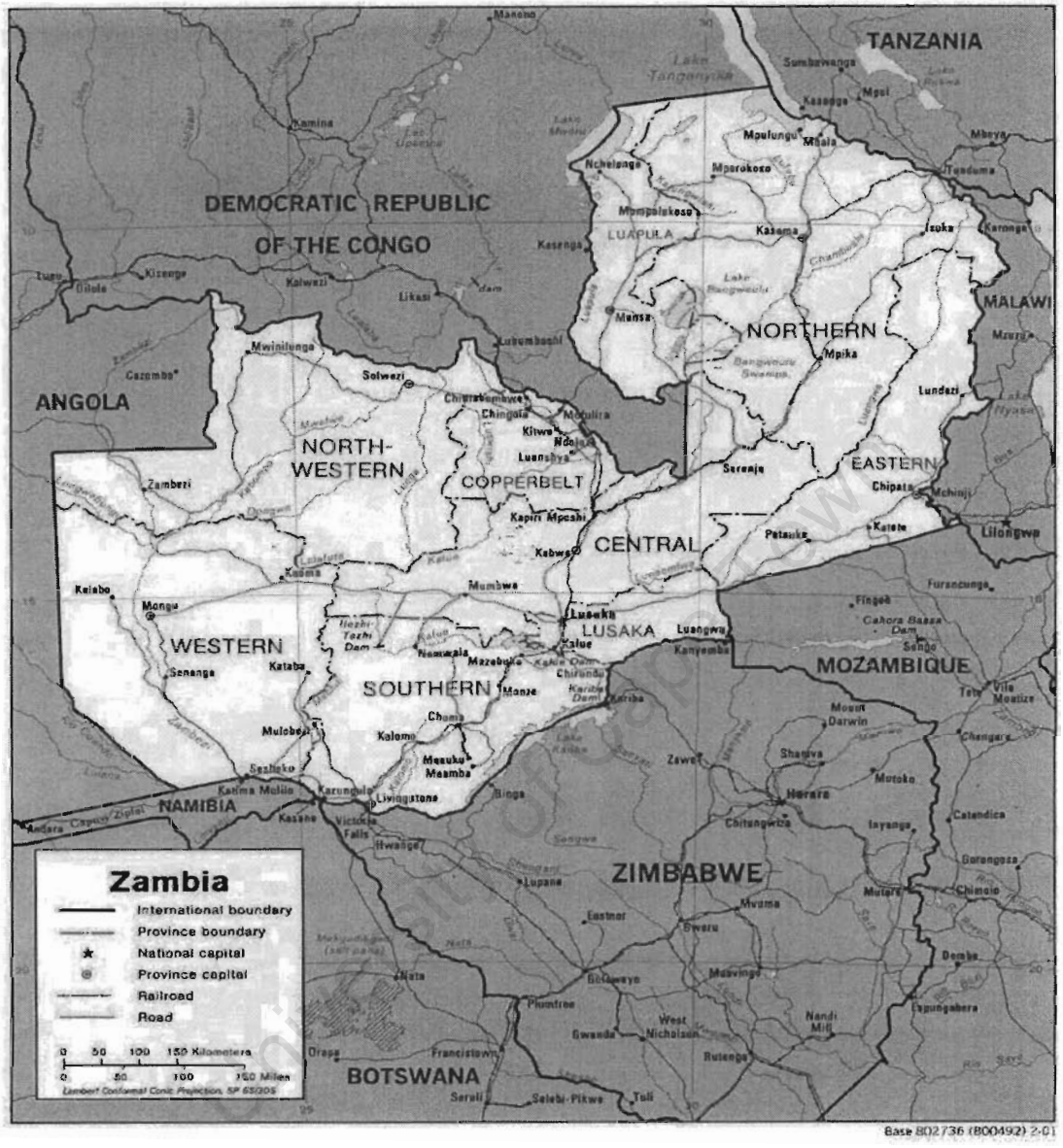
Figure 2.2: Geographical location of Zambia



Source: (World Atlas, 2004)

Zambia covers a total land area of 752,612 km^2 and is administratively divided into nine provinces, namely: Central, Copperbelt, Lusaka, Western, Luapula, Northen, Northwestern, Eastern and Southern. The provinces are in turn sub-divided into districts, which are currently 72 (figure 2.3). Each province has an administrative headquarters and the four major cities are Lusaka, Ndola, Kitwe and Livingstone (ECZ, 2001:1).

Figure 2.3: Administrative boundaries



Source: (World Atlas, 2004)

The country is situated on the great plateau of Central Africa, with average altitude of 1,200 above sea level. The country's highest elevations range between 1,525 and 1,650 meters above sea level. These are: in the Northern Province of the country (Mbala, Mporokoso and Mpika); in Central Province (Serenje); and in Northwestern Province (between Solwezi and Mwinilunga). There is a mountain zone in the Northeastern part

of Zambia bordering Malawi that exceeds 1,800 metres above sea level, whose highest point is 2,164 metres above sea level (ECZ, 2001:2).

Out of the total land area of 752,612 km^2, 25% is used for agriculture while urban development takes up only 2%. Wildlife and forest development take 30% and 9% respectively with the remaining part going to unspecified areas and arable land (12% and 22% respectively) (ECZ, 2001:2).

2.3.2 Climatic and physical conditions

- Climate

  Zambia's climate is sub-tropical. The annual rainfall decreases from an average of 1,000 mm in the northern parts of the country to an average of 600 mm in the southern part. The mean annual temperature ranges between 18^o and 20^o Celsius (ECZ, 2001:2).

- Drainage Surface

  Zambia has two major river basins, namely the Zambezi and Congo basins into which all river systems discharge (Figure 2.3).

  The country has a fairly dense river network, except in the west, offering good opportunities for the development of hydropower generation and irrigation. The water availability in the country's small rivers differs remarkably due to considerable changes in precipitation from the northern part of the country to the southern part (ECZ, 2001: 2-3).

2.3.3 Macro-economic performance

Sector reforms were pursued aggressively. Most sectors started with the refinement of policy sectors and strategies to guide and direct development. The major thrust of the sector reforms was to privatize state owned companies. The Zambia Privatization Act was passed in 1992 to facilitate the privatization process. This has seen to the privatization of over 200 state owned enterprises and setting up of regulatory utilities to ease procedures for establishing business enterprises (ERB, 2002: 14).

The performance of the economy fluctuated from 1995 to 2000 (Table 2.1). The Gross Domestic Product (GDP) was positive for two consecutive years, 1996 and 1997. This was then followed by a sharp decline in 1998/9. The poor GDP performance in 1998 could be attributed to the poor performance of the two main economic sectors, agriculture and mining (ECZ. 2001: 9-14).

Table 2.1: % GDP – 1995 to 2000 (Real growth rate)

Sector	1995	1996	1997	1998	1999	2000
Agriculture, forestry and fishing	33.4	-0.6	-5.1	1.2	10.1	1.6
Mining and quarrying	-27.6	2.8	2.2	-25.1	-24.8	0.1
Manufacturing	-0.4	5.5	5.1	1.8	2.8	3.6
Electricity, gas and water	-1.6	-5.6	4.2	0.6	2.5	1.2
Construction	-3.4	-11.0	29.0	-9.1	3.2	6.5
Wholesale and retail trade	-10.6	33.1	4.5	3.5	4.4	2.3
Restaurants and hotels	5.2	8.4	7.2	3.8	-6.2	12.3
Transport, storage and communication	-6.6	7.6	-0.2	8.5	5.7	2.4
Financial institutions and insurance	19.3	-8.3	0.3	0.4	2.5	-0.6
Real estate and business services	8.2	15.5	12.6	12.7	13.8	17.0
Community, social, and personal services	-1.2	3.3	0.4	-2.3	8.4	-0.5
Zambia	-2.5	6.6	3.3	-1.9	-2.2	3.6

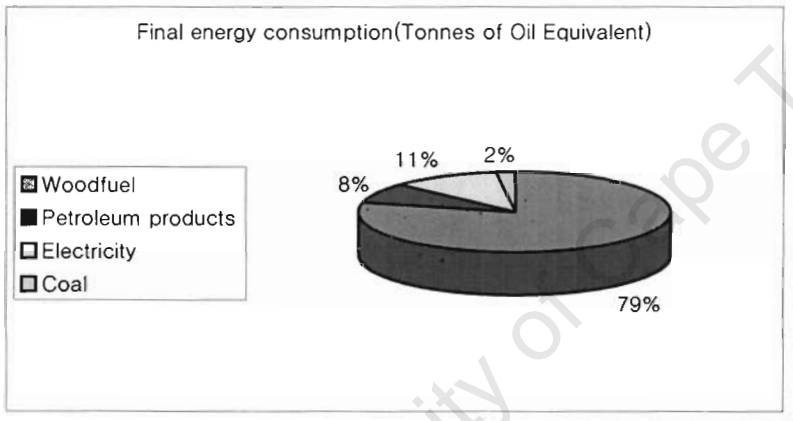
Source: (MFED, 1999)

2.4 Zambian energy sector

2.4.1 Energy resources

Zambia is rich and diversified in energy resources. It has four basic forms of energy, which are hydro, coal, petroleum and wood. Of these four basic resources only petroleum is wholly imported. Zambia is also richly endowed with new and renewable sources such as solar and wind though they are very little exploited.

Figure 2.4: Energy resources in Zambia

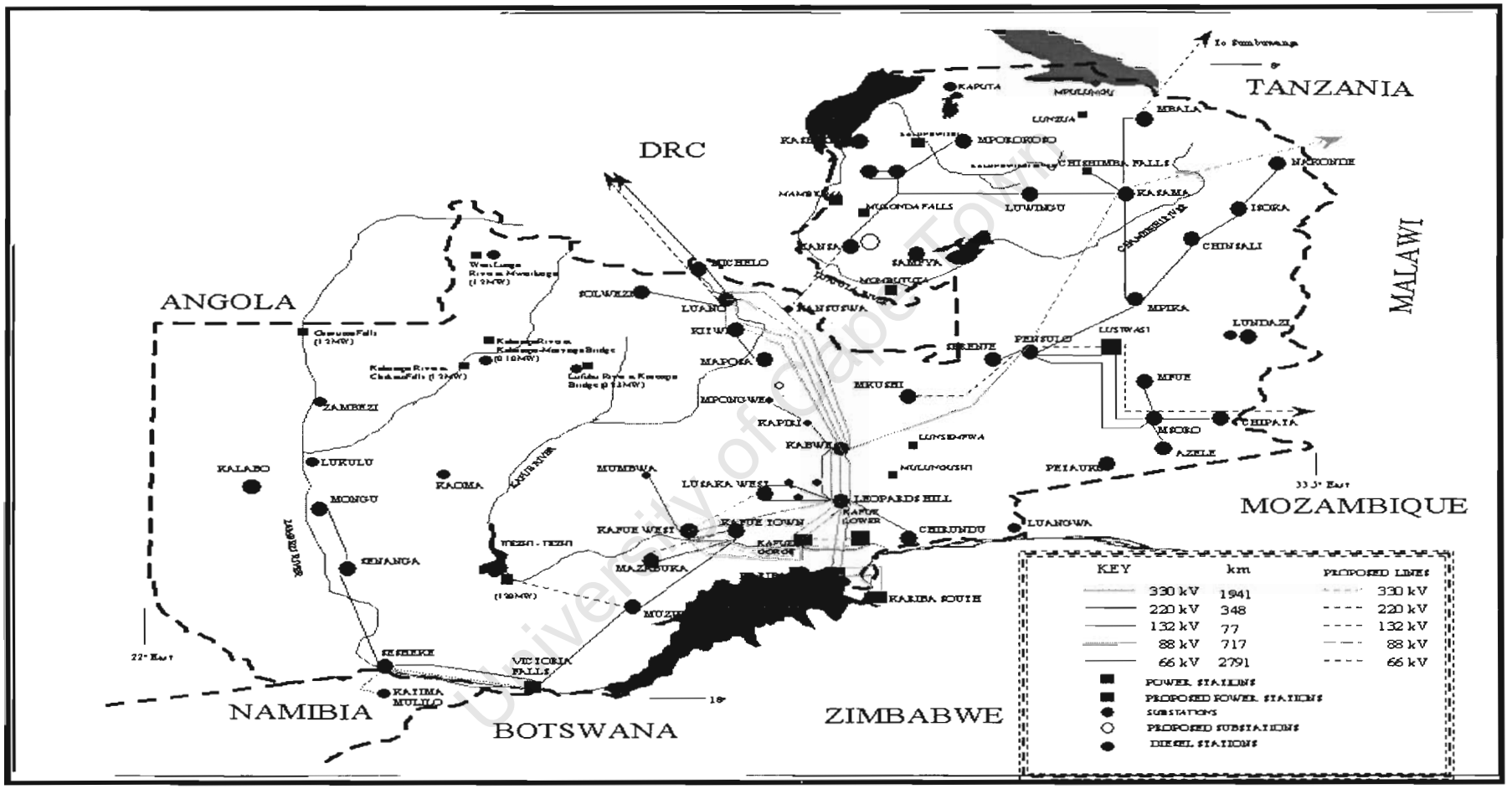


Source: (MEWD, 2000)

2.4.2 The National grid

The main national grid stretches from the three large hydro power plants located in the southern region of the country, up north via Lusaka and to the Copperbelt, the mining region. The level of the national grid coverage over the whole of the country is low. With the total land surface area of 752 000 square kilometers, the grid has only 3 290km of transmission lines (ERB, 2002).

Figure 2.5: The Zambian National Grid and Interconnections in Southern Africa



Source: (ZESCO, 2004)

2.4.3 Isolated mini grids

In its rural electrification programs, the national utility ZESCO's preferred approach is extension of supply from the main grid, but this has proved too costly for areas that are far away from the grid. In such cases isolated diesel generators or mini hydro plants are used to supply electricity. The utility has 8 diesel power plants and 4 mini-hydro plants (ZESCO, 1999a: 34)

2.4.4 Hydropower

Zambia forms part of the Great Lakes Region. It has substantial hydropower reserves from lakes and rivers. The hydropower potential is estimated at 8 400 MW although only 1 716 MW is the installed capacity contributing 11% of the total energy use. Hydroelectric plants represent 92% of the installed capacity and account for almost all the electricity production (99%). The major plants are Kafue Gorge (900MW), Kariba North Bank (600MW) and Victoria Falls (108MW) (Figure 2.5). The important international connections include 330kV lines to Zimbabwe and a 220 kV line connecting the Copperbelt to the Democratic Republic of Congo (MFNP, 2002b: 99).

2.4.5 Coal

Coal in Zambia is produced by Maamba Collieries, the only coal mine. The mine has estimated reserves of about 80 million tonnes. The mines are the leading consumers of coal followed by the cement manufacturing companies. Zambia does not use coal for electricity generation on a national scale except a few industries. The National Energy Policy measures aim at including coal for future power generation.

2.4.6 Petroleum

There are no proven petroleum reserves in the country and hence it is the only energy source wholly imported. The TAZAMA Pipeline Limited which is jointly owned by Zambia and Tanzania is responsible for transporting spiked crude petroleum from Dar-es-Salaam to Ndola through a 1 701 km pipeline (Kalumiana, 2002: 7) The petroleum products are mainly used in the transport sector. ZESCO also uses diesel for electricity generation for some isolated areas in the country. It has 8 diesel electricity generation plants (ZESCO, 1999a: 34). Paraffin is also widely used by the majority of households for lighting and cooking.

2.4.7 Woodfuel

Woodfuel is the most common source of energy. Woodlands cover about 81% of the total land area in Zambia. Wood resources have decreased over the years. The consumption of wood increased by 34% from a total of 9 160 tonnes in 1986 to 12 300 tonnes in 1999. According to the Deputy Director of DoE, the household sector is by far the most dominating consumer (Kalumiana, 2003).

2.5 Organization of the energy sector

The Ministry of Energy and Water Development (MEWD) has the overall responsibility to develop, articulate and implement the National Energy Policy (NEP).

The Department of Energy (DoE) is the chief advisor to the Minister of Energy and is the government executing arm of all energy related policy matters.

The Zambia National Oil Company Limited (ZNOC), a government owned company

used to be responsible for the importation of all petroleum products and bulk sale to all oil-marketing companies in Zambia. The company was liquidated in April 2002 (MFNP, 2003:65). This did not affect the supply of petroleum products on the market as government had already put in place measures to encourage the private sector to supply petroleum products (MEWD, 2000a: 7).

However after INDENI Petroleum Company Limited, the government owned refinery was damaged by fire in May 1999, the Government issued a Statutory Instrument 119 of 1999 opening the way for other oil marketing companies to get involved in the importation of refined products. As at January 2000, nine companies had obtained licenses from the Energy Regulation Board for importation of finished products (MEWD, 2000a: 7). The private oil marketing companies are responsible for the distribution of petroleum products.

The Zambia Electricity Supply Company Limited (ZESCO) is responsible for generation, transmission, distribution and supply of electricity. The Copperbelt Energy Company (CEC) is a private electricity distribution company that buys power from ZESCO in bulk and sells it to the mines on the Copperbelt. The company was formed in 1997 following the privatisation of Zambia Consolidated Copper Mines (ZCCM) Power Division. CEC is a UK-led company formed between National Grid and Cinergy Global Power, part of the US Cinergy Corporation (Clark and Marks, 1999:111). The Kariba North Bank Company Limited (KNBC) is a company responsible for running the 600MW Kariba North Bank Power Station. This is a government owned company.

The Energy Regulation Board (ERB) through the Energy Regulation Act No 16 of 1995

is the sole licensing authority for operators in the energy sector. It is also responsible for their supervision and seeks to promote competition and ease of entry into the energy sector. ERB further, investigates and remedies energy consumers' complaints.

2.6 Power sector policy

The National Energy Policy (NEP) of 1994 which articulates the national priorities in the energy sector mainly focuses on promoting optimum supply and utilization of energy resources, especially naturally occurring forms, to facilitate the socio-economic development and maintenance of a safe and healthy environment (MEWD, 1994). This first national energy policy still guides the development of the energy sector. The policy has not been updated since then, but it will need upgrading considering the further development of the restructuring of the electricity industry; it will also have to define priorities and means of rural electrification.

Although there is no specific policy on rural electrification, the government created the Rural Electrification Fund (REF) in 1994 to increase rural access to electricity. This fund is replenished from a levy of 5% on all electricity bills. In spite of the existence of this fund there is still considerable scope for improving its operations in terms of its effectiveness and efficiency.

3. ELECTRIFICATION PROGRAMS

Electrification programs in Zambia can be traced way back to the late 1950s, in the colonial periods when electricity was extended to European farmers in the rural areas. Electricity was extended from the British Military Overseas Administration (Boma) centers (local headquarters for colonial administration). The Boma centers were the first urban centers to be electrified and most of them serve as district administrative centers. After independence in 1964 however, electrification programs were targeted at providing power to the district administrative centers through the main grid, small hydropower stations or diesel stations (MEWD, 1995).

The electrification programs face a number of challenges especially in rural electrification. Rural electrification projects that basically refer to the electrification of poor households, require high capital costs with low financial returns compared with corresponding urban projects. This is because rural areas:

- Require small loads and are scattered, at large distances from the nearest main grid.
- Are sparsely populated with relatively fewer people connected to the line so that revenue collected is much less compared to the supply cost.

3.1 Tariff setting

Pricing is an important instrument that promotes efficient allocation of economic resources. It should therefore reflect both the cost and the true economic value of a commodity and giving the right signals to the consumers (MEWD, 1994:37).

The Zambian national energy pricing policies advocate for a simple and transparent mechanism in order to inspire confidence in customers. The prices take into account all economic costs and specific pricing requirement for each energy source as follows:

- Petroleum: the pricing formula includes all the elements in supply, distribution and marketing of products namely replacement costs, operational costs and profit.

- Electricity: the pricing formula for setting tariff is based on the Long Run Marginal Cost (LRMC), which is defined as the incremental cost per kilowatt-hour (kWh) of supplying an additional and sustained kWh of demand that would require putting up additional capacity of generation. The costs therefore include the costs of planned additional investments in generation using a horizon of at least six to ten years. The levels of the tariffs are also influenced by the burden imposed on the systems and load factors of various customers.

- Coal: the pricing of coal includes cost of mining operations and maintenance, haulage, environmental quality maintenance and profit.

- Woodfuel: the price of woodfuel is not established, as it is already competitive. The license fees charged reflect environmental costs associated with wood fuel and are used for forest management.

- New and Renewable Sources of Energy technologies: these are priced in such a way as to encourage their wider application through the provision of positive fiscal incentives

3.2 Subsidies to the poor and other social benefits

Firewood and charcoal have no direct subsidies unlike electricity and paraffin. The failure of the government to collect the required legal fees from the charcoal producers and distributors in a way acts as a subsidy.

3.2.1 Electricity

The electricity subsidies are indirect in that the tariffs are below the Average Cost Based Tariffs (ACBT). At these tariffs below the ACBT, ZESCO is able to cover it's total annual costs ranging from operation, administration and capital costs (depreciation and rate of return on assets) for generation, transmission and distribution according to the Manager-Research Economic and Financial Analysis at ERB (Chiinda 2003). Since the difference in the LRMC, real tariff rate and that at which the customers pay for electricity is considered a cost to the utility, this difference is the subsidy. The electricity subsides therefore constitute the difference between the prevailing tariff and the real tariff.

Since the electricity tariffs do not include the costs of connection and internal wiring, the subsidies therefore do not apply to these costs. The costs do not also cover the cost of planned additional investments in generation.

The household tariffs are divided into three categories based on their consumption levels as indicated in the Table 3.1.

Table 3.1:Metered residential tariffs (capacity up to 15kVA)

Category	Energy charge/kWh (Kwacha)	Energy charge/kWh (US dollar)
R1-Consumption up to 300 kWh	60.00	.016
R2-Consumtion 301-700 kWh	85.00	.023
R3-Consumption above 700 kWh	140.00	.038

Source: (ZESCO, 2001)

The social services tariffs, which are meant for schools, hospitals, orphanages, churches, water pumping and street lighting and unmetered residential tariffs are fixed at specific monthly charges (Table 3.2). The unmetered residential households are those households, which use less than 15 Amps per month basically for lighting. These households are generally located in the peri-urban areas surrounding the major cities and are supplied with the limited amps of power.

Table 3.2: Unmetered residences and social services

Category	Energy charge/kWh (Kwacha/US$)	Fixed monthly charge (Kwacha/US$)/ per month
L1-Consumption up to 2A	0	4 200.00/1.16
L2-Consumtion 2A-15A	0	15 200.00/4.20
Social Services	116.00/0.03	20 000.00/5.54

Source: (ZESCO, 2001)

3.2.2 Paraffin

Government forgoes revenue on paraffin due to the existing tax regime. The value added tax, which stands at 17.5%, is not charged on paraffin neither the 15% road levy that applies to petrol and diesel. Custom's duty on paraffin is 10% instead of 45% as applicable to all other petroleum products.

3.2.3 Charcoal

There is no subsidy on charcoal. It is however notable that due to the failure of the Department of Forestry under the Ministry of Environment and Natural Resources, to collect legal fees, there is a substantial amount of revenue forgone. Less than 5% of all transporters acquire licenses whereas virtually no producer acquires any license at all. In 2001 the forgone revenue on each bag of charcoal produced was US $ 0.35. With a minimum of 15 million bags consumed annually and a 5% levy compliance rate, the forgone revenue was in the order of US $ 5.25 million (Kalumiana, 2002: 24; 2000).

3.3 Impacts on poor households

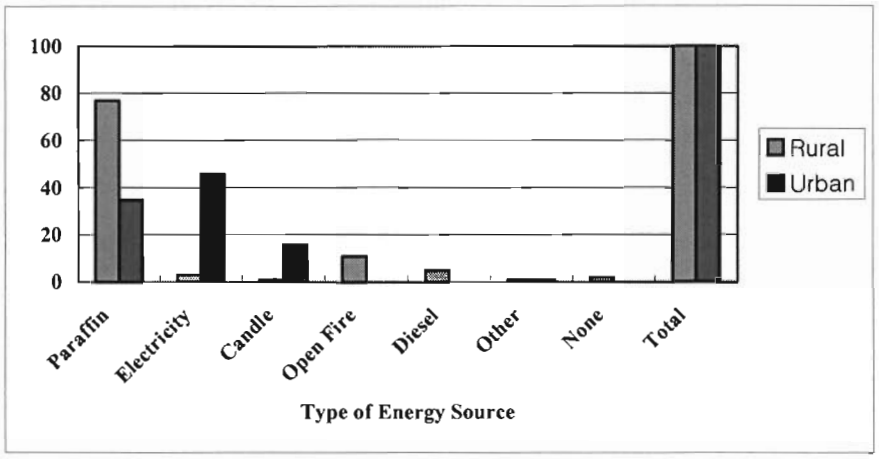
The impacts of electrification on poor household can be realized by using information on levels of lighting and energy used for cooking. Table 3.3 shows the distribution of households by type of energy used for lighting.

Table 3.3: Percentage distribution of households by main type of lighting energy used in Zambia 1998.

	Type of Lighting Energy								
	Paraffin	Electricity	Candle	Open Fire	Diesel	Other	None	Total	Total number of households
All Zambia	62	19	7	7	4	1	1	100	1 874 000
Rural	77	3	1	11	5	1	1	100	1 204 000
Urban	35	48	16	0	0	0	0	100	670 000
Small Scale farmers	78	2	1	12	5	1	1	100	1 049 000
Medium scale farmers	88	3	1	2	6	1	0	100	30 000
Large scale farmers	57	26	7	1	8	0	0	100	1 000
Non- agricultural	68	9	6	9	5	2	1	100	127 000
Low cost areas	42	37	20	0	0	0	0	100	494 000
Medium cost areas	21	73	5	0	0	0	0	100	90 000
High cost areas	13	82	5	0	0	0	0	100	93 000
Province									
Central	67	20	3	2	7	0	0	100	184 000
Copperbelt	49	41	8	1	1	0	0	100	326 000
Eastern	83	2	2	7	4	0	2	100	256 000
Luapula	85	6	2	7	0	0	0	100	138 000
Lusaka	29	41	26	1	2	1	0	100	274 000
Northern	75	6	1	11	5	0	0	100	227 000
North-Western	74	3	1	12	8	1	2	100	108 000
Southern	67	17	4	6	5	1	2	100	205 000
Western	54	3	2	32	3	2	4	100	161 000

Source: (CSO, 2000)

Figure 3.1: Percentage distribution of households by main type of lighting energy source



Source: (CSO, 2000)

The majority of households in Zambia use paraffin for lighting followed by electricity and other sources. For the majority in rural areas where the highest number of poor households is found as many as 77 % use paraffin for lighting whilst 3 % use electricity. In urban areas 48% of households use electricity for lighting followed by paraffin 35% and 16% candles (CSO, 2000: 133).

It should be noted though that in the rural areas a significant proportion of large-scale farmers use electricity for lighting (26%) and that 82% of the electricity lit households in urban areas occur in the high cost areas. In fact, it is only in the capital city Lusaka where electricity ranks the highest whereas in all other provinces paraffin dominates. In the Western Province some households rely on open fires for lighting (Table 3.3). It is worth noting that diesel which poses environmental hazard and is highly flammable is used by some poor households for lighting. These households use hand made lamps usually made using an empty bottle with a thin piece of cloth as a wick.

When it comes to cooking, electricity ranks the lowest as most households use wood fuel for cooking (Table 3.4)

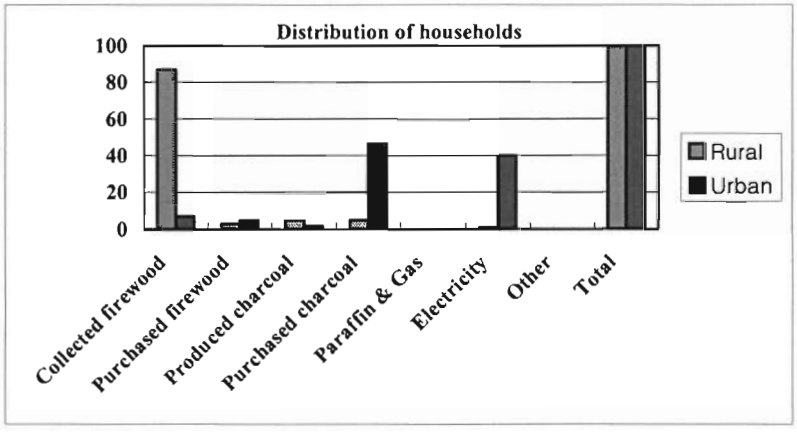
Table 3.4: Percentage distribution of rural/urban households by main type of cooking energy Zambia 1998.

	Type of cooking energy								
	Collected firewood	Purchased firewood	Own produced charcoal	Purchased charcoal	Paraffin & Gas	Electricity	Other	Total	Total number of households
All Zambia	58	3	4	20	0	15	0	100	1 874 000
Rural	87	3	5	5	0	1	0	100	1 204 000
Urban	7	5	2	47	0	40	0	100	670 000
Small Scale farmers	89	2	5	3	0	1	0	100	1 052 000
Medium Scale Farmers	90	4	2	3	0	2	0	100	31 000
Large Scale Farmers	57	3	6	7	11*	16	0	100	2 000
Non- Agricultural	69	4	5	16	0	5	0	100	128 000
Low Cost Areas	8	4	2	56	0	29	0	100	494 000
Medium Cost Areas	5	5	1	27	0	62	0	100	90 000
High Cost Areas	3	6	0	18	0	73	0	100	93 000
Province									
Central	61	5	1	17	0	16	0	100	184 000
Copperbelt	19	3	4	40	0	33	0	100	326 000
Eastern	89	5	0	5	0	1	0	100	256 000
Luapula	49	2	31	16	0	3	0	100	138 000
Lusaka	16	3	0	44	0	35	0	100	274 000
Northern	84	1	2	9	0	4	0	100	227 000
North-Western	88	3	2	6	0	1	0	100	108 000
Southern	72	5	0	10	0	13	0	100	205 000
Western	92	4	0	2	0	2	0	100	161 000

Source: (CSO, 2000)

*The 11% represents a small number scattered around the country such that when compared to other major sources of cooking the figure is almost 0%. The figure is merely to indicate that a handful of large-scale farmers countrywide do use gas for cooking.

Figure 3.2: Distribution of households by main type of cooking energy used by rural/urban, stratum and province, Zambia 1998



Source: (CSO, 2000)

61% of the total households used firewood for cooking followed by charcoal, which was either purchased or home produced at 24% and only 15% used electricity for cooking (Table 3.4). In rural areas as many as 90% of the households used firewood for cooking and 49% of urban households used charcoal for cooking. In urban low cost areas 56% of households used purchased charcoal for cooking. The 15% of those households that used electricity for cooking were mostly from the high cost urban areas as 73% of these households cooked with electricity.

Paraffin and gas are rarely used for cooking in Zambia. The availability of gas and paraffin stoves is not common and these are usually more expensive compared with braziers, which can be used for both charcoal and firewood. Large-scale farming households used electricity for cooking (16%) and 11%* of them used gas (CSO, 2000: 134).

This shows that households that have access to electricity do not necessarily use it for cooking, that is, 15% of the 19% with access use it for cooking (ERB, 2002: 13). At

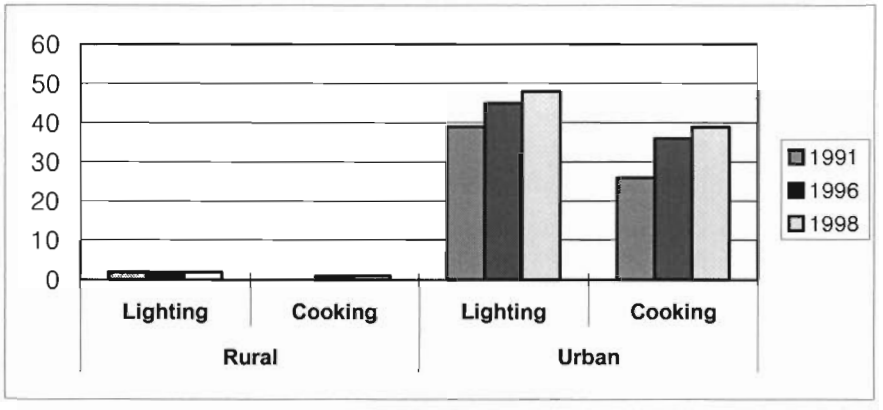
national level, access levels to electricity are low, 19%, with the rural areas having the least at 2%. The levels of access to electricity have remained stagnant since 1991(Table 3.5).

Table 3.5: Electricity access indicators

Electricity access indicators (%) 1991-1998				
		1991	1996	1998
All Zambia	Lighting	18	17	19
	Cooking	11	13	15
Rural	Lighting	2	2	2
	Cooking	0	1	1
Urban	Lighting	39	45	48
	Cooking	26	36	39
Central	Lighting	17	18	20
	Cooking	10	12	16
Copperbelt	Lighting	35	35	41
	Cooking	20	29	33
Eastern	Lighting	5	4	2
	Cooking	3	2	1
Luapula	Lighting	8	5	6
	Cooking	2	3	2
Lusaka	Lighting	40	44	42
	Cooking	33	37	36
Northern	Lighting	10	3	6
	Cooking	4	1	4
North-Western	Lighting	16	5	3
	Cooking	6	3	1
Southern	Lighting	13	8	16
	Cooking	6	5	12
Western	Lighting	8	4	3
	Cooking	4	2	2

Source: (ERB, 2002)

Figure 3.3: Electrification level trends



Source: (ERB, 2002)

It is noticeable that whilst electricity levels remained low there have been declining trends in the rural areas. Through an interview with the Chief Economist at ZESCO Head Office in Lusaka in April 2003, the declining trends could be due to ZESCO coverage not keeping up with the growth in the number of households and or by the inability of households previously using electricity, to pay for the service (Kasanda, 2003).

3.4 Affordability of electricity

According to the ZESCO tariff study (1999b), the average annual consumption of the low, medium, and high income groups was estimated to be 900, 4,800 and 11,700 k/Wh per year respectively (ERB, 2002:13). Using this estimate and average retail tariff for the year 2000-01, the electricity costs inclusive of excise duty and value added tax (VAT) for each income category are as summarized in Table 3.6.

Table 3.6: Percentages of electricity costs in monthly income

Income Group Kwacha/US $	Average Income K/month/ US $/month	% of Popu -lation	Ann -ual kWh	Month ly kWh	Energy Charge (ZMK /US $)	Excise Duty (ZMK/ US$)	VAT (ZMK/ US$)	Monthly Cost (ZMK/ US$)	% Cost in monthly income
< 75 000/ 19.48	33 310/8.55	45	900	75	10 656/2.77	746/0.19	1865/0.48	13 267/3.45	41
75 000-300 000	259 911/67.52	41	4 800	400	56 832/14.78	3978/1.03	9946/2.58	70 756/18.38	27
>300 000/77.94	972 543/252.67	14	11 700	975	138 528/35.99	9697/2.52	24242/6.30	172 467/44.80	18

Source: (ERB, 2002)

3.5 Household expenditure

Based on the LCMS of 1998, food accounted for the highest share of 59% of the total household expenditure in the country (Table 3.7). The expenditure on food in urban households areas was 51% compared with as much as 72%, almost three quarters of the total household expenditure in the rural households.

Table 3.7: Percentage share of household expenditure on different items for the total (Zambia) rural and urban population, 1998

Items	Zambia	Rural	Urban
Food	59	72	51
Housing	5	2	8
Clothing	7	6	7
Transport	7	5	9
Remittances	3	2	3
Education	4	2	5
Medical Care	2	1	2
Personal Services	9	5	11
Alcoholic Beverages and Cigarettes	4	5	4
Total	100	100	100
Total Number of Households	1 890 000	1 214 000	676 000

Source: (CSO, 2000)

This, therefore, left very little income to be spent on other expenses. Electricity was included in the housing component (Table 3.8) at 2% for rural households and 8% for urban households (ERB, 2002:13).

Table 3.8: Percentage distribution of household expenditure on housing by rural/urban, province Zambia 1998

	Rent	Water	Electricity	Lighting (candle, paraffin, diesel	Cooking (charcoal firewood)	Housing maintenance	Total number of households
All Zambia	32	9	20	14	17	9	1 890 000
Rural	4	2	6	45	32	11	1 214 000
Urban	37	10	23	8	14	8	676 000
Small scale farmers	3	1	4	49	31	12	1 052 000
Medium scale farmers	1	0	10	79	13	4	31 000
Large scale farmers	0	5	32	33	1	29	2 000
Non- agricultural	12	2	7	24	50	5	128 000
Low cost areas	36	6	20	10	19	8	494 000
Medium cost areas	37	13	26	6	11	5	90 000
High cost areas	39	17	29	2	4	9	93 000
Province							
Central	26	9	18	23	17	7	184 000
Copperbelt	30	5	22	12	18	10	327 000
Eastern	15	8	5	42	27	7	257 000
Luapula	7	2	12	22	47	11	137 000
Lusaka	42	10	22	6	12	8	282 000
Northern	11	6	18	33	26	5	228 000
North-Western	4	5	8	44	27	12	107 000
Southern	22	9	23	19	17	12	210 000
Western	10	16	15	41	15	3	158 000

Source: (CSO, 2000)

Based on the distribution of incomes in a study carried out by the power utility ZESCO, the monthly electricity cost for the lowest income group represents 41% of the total monthly income, 27% for the middle and 18% for the highest income group (Table 3.6). These values clearly indicate that the lowest income groups in which most of the poor fall have a high economic burden of meeting their energy requirements. This group alone represents 45% of the population.

To calculate the housing expenditure the data collected on consumption of own produce including both food and non-food items such as residential houses, which the majority of poor households owned, were used. The amounts consumed of both types of items were converted to cash values using their respective quantities used by the household and food consumed by their respective unit prices.

Closer analysis of the housing expenditure (Table 3.8) indicates that 23% of it in urban households was for electricity and 14% of it for cooking fuel. In rural area households, 45% of the housing expenditure was used on fuel for lighting such as candle, paraffin and diesel. Furthermore 32% of it was spent on fuel for cooking only, namely firewood and charcoal. Other housing expenditure items are as indicated in Table 3.8.

The levels of income (Table 3.6) and the housing expenditure (Table 3.7) clearly indicate that the costs of energy sources are well above the affordability of the low-income households. Low-income households are required to use 41% of their income on electricity whilst they can only spare 2% of their income housing expenditure. Of the income spared as housing expenditure in rural households, only 6% of it was used for electricity (Table 3.8).

3.6 Pamodzi Low Cost Electrification Project

The overall objective of this project was to contribute to a more rapid and sustainable electrification of Zambia's peri-urban areas. The study was carried out in 1996 by ZESCO funded by the Swedish International Development Agency (SIDA) and conducted by the Stockholm Environment Institute (SEI).

Pamodzi, a peri-urban area was electrified with a view of making the clients active users of electricity by supplying appliances- cooker and pressing iron right from the start. An initial survey on pre-electric energy use, social conditions and indications on the costs indicated that the households could pay for an electricity connection. Only 70% of the households in Pamodzi were able to afford and willing to get connected to the grid electricity.

The prospective customers were required to make an initial down payment of 135 000 Kwacha (US$85) 25% of the total installation cost of 540 000 Kwacha (US$430). This was considered as a condition, necessary for ZESCO to secure credit contracts to the selected households. This amount however is very substantial for low-income households. The remainder of the connection fee was to be repaid through additions to the electricity bill over a period of five years at an average interest rate of 9 267 Kwacha (US$ 6) per month.

The energy use in the electrified houses in Pamodzi changed dramatically after electrification. The charcoal consumption went down to less than half of what it used to be (Table 3.9). The major improvement in lighting changed the quality of life in the evening and radios and television sets were purchased. The use of paraffin for lighting drastically reduced by almost 50%, that is from 97% to 50%. For the women, the use

of charcoal, which is labor intensive, was replaced with electric cookers (Arvidson and Enders, 1998).

Table 3.9: Energy use and charcoal consumption before and after electricity connection in Pamodzi

Fuel type used/households	Before connection (1995)	After connection (1997)
Households using paraffin (%)	97	50
Households using candles (%)	11	80
Households using wood (%)	37	5
Households using charcoal (%)	100	85
Charcoal bag per month (average)	2,3	1,0

Note: the content of each bag of charcoal is around 50 kg.

Source: (Arvidson & Enders, 1998)

The electricity consumption of Pamodzi was charged through credit meters. As was expected by the utility most of the customers connected paid their electricity bills (Table 3.10)

Table 3.10: Electricity consumption and payment of bills in Pamodzi Household Project

Consumption and bill payment	Per household
Electricity consumption, kWh/month	87
Connection fee paid (ZMK / US $ average)	143,000/114
Received bill %	77
Paid bill %	98

Source: (Arvidson & Enders, 1998)

3.7 Solar Electrification Projects

The DoE embarked on a pilot project of providing Solar Photovoltaic Electricity (SPV) through Energy Service Companies (ESCOs). The project started in 1999 with the financial support of SIDA (Swedish International Development Agency). The project was based on the fee for service approach.

The objective of this project is to give people in rural areas access to electricity services. The project has set up an ESCO in each of the districts in Nyimba, Chipata and Lundazi in the Eastern Province and has provided 400 households with electricity for lighting and for running radio or television.

According to Prof. Jain of the Physics Department of UNZA, the Energy Environmental Physics Group at the Physics Department has been the focal point for training the ESCO technicians (Jain, 2003b). The Solar Home Systems (SHS) are owned by the ESCOs who maintain and repair them and the users simply get electricity services against payment of a monthly fee of K30,000 (US $ 6.00).

Even though MEWD and SIDA have drawn up an expansion plan to enable the installation of 20,000 SHS over a period of 10 years for rural electrification, the high upfront cost have been found to be the main barrier for the typical village households. The average cost of a 50 Wp SHS installed under an ESCO project is about $1000. (MEWD, 2002).

3.8 United Nations Industrial Development Organization (UNIDO)-Global Environment Facility Projects (GEF)

These are projects run under DoE as part of the Climate Change GEF projects. There are currently two projects running in their prefeasibility stages in Zambia. According to the two Project Coordinators of each project, Dr. Lemba Nyirenda (Information and Communication Technology: ICT) and Mr. Elijah Sichone (Mini-Grids), the two projects will contribute to the government's objective of providing electricity and energy services to rural areas and improve their standard of living through income generating activities (Nyirenda, 2003;Sichone, 2003).

The overall objective of the Isolated Mini Grids Project is to provide electricity and energy services for income generating activities to rural households and communities that cannot be reached by the main grid linked (UNIDO, 2003). The ICT project's overall objective is to link renewable energy systems for electricity generation to the economic and social development potential of ICTs based in multipurpose telecentres (UNIDO, 2003).

The projects focus is on the use of New and Renewable Sources of Energy (NRSE) in the formation of local mini grids. Both projects await further funding from UNIDO to proceed from the prefeasibility stages.

3.9 Summary

The long instituted rural electrification program has had negligible impacts on the poor, as noted from the stagnant levels in the rural areas. The poor still wrestle with the economic burden of meeting the required amount of money for internal connection and purchase of the ready board, making the access of electricity unaffordable.

The economically empowered people use the electricity subsidy that was meant for the poor. Following the Structural Adjustments Programs (SAP), Local Governments were forced to sell the council owned houses to the sitting tenants who could afford to buy the houses and if they could not afford the houses were offered to the general public as a way of raising revenue. Those who could not afford to buy were forced to relocate to lower forms of houses either in the townships or remote rural areas. The few low cost houses that were exempted from the sale included the cultural heritage sites such as the

Kabwata Cultural Village. The houses sold included those that were on the social electricity tariff lifeline and some lines have since been upgraded (Kasanda, 2003).

The poor are therefore left out in the remote areas were electrification is conditional based on the economic viability of the area and their potential to cover the upfront high costs of the ready board and internal wiring.

These foregoing reasons explain the high reliance of poor communities on alternative forms of energy other than electricity.

The income levels of the poor are insufficient to meet their electricity needs and hence higher priority is placed on their greater needs of food and shelter and leaves little or nothing to cover costly energy needs. This therefore forces them to opt for energy sources such as firewood and charcoal where government foregoes the revenue in form of taxes on the use and production of these resources.

The pilot project in Pamodzi indicates that when the needs of the end users are identified in the electrification projects and micro credit measures are put in place to assist them in obtaining the first time access to electricity, this results in improved livelihoods of the low-income groups. This also indicates that it is of utmost importance how well energy utilities actually deliver appropriate and adequate energy services to meet the needs of their many different types of customers (AFREPREN, 1996).

4. POWER SECTOR REFORMS

4.1 Structural reforms in Zambia

At independence in 1964, Zambia inherited a strong mining-based economy. It deteriorated in the mid-1970s following a sharp decline in copper prices, compounded by the oil shock. Foreign borrowing was increased to minimize the decline in living standards. During these early years, the policy to diversify the economy through the industrialization strategy, import substitution and reduced dependency on mining was implemented. This encouraged companies to produce for the domestic market but did little to build the required capacity to export. However with little foreign exchange being earned in the 1990s, the import substitution industrialization and economic diversification strategies failed (MFNP, 2002a: 15).

In an effort to redress this problem, the government adopted the Structural Adjustment Program (SAP). The pace of implementing SAPs, in a stagnating economy, accelerated in the 1990s under the World Bank Policy conditional loans on institutional restructuring (WRI, 2002:2). This led to the closure and/or privatization of public enterprises. Price controls were lifted and agricultural input and output markets opened up to private sector entry. In the foreign exchange market, the exchange rate was freed and capital controls were totally removed. Import controls were also abolished except for a small number of dangerous materials (MFNP, 2002a: 15).

4.2 Impacts of structural reforms on the poor

A limited number of initiatives, such as training and job search programs associated with the privatization program and poverty alleviation, were implemented to enhance employment and incomes. However, their thrust was through the implied benefits of economic growth to reduce poverty (World Bank, 2003).

However, many formal sector jobs were lost during the period of implementing structural reforms. Although some new jobs were created, they were not enough to upset the balance. Formal sector employment went down from 12 percent to 11 percent between 1996 and 1999. Unemployment also came down from 18.2 percent to 9.5 percent of the labor force, which meant an increase in informal sector employment (MFNP, 2002a: 17). This growth, however, did not contribute to a reduction in poverty for, between 1996 and 1998 while unemployment came down, poverty increased, from 52% in 1991 to 73% in 1998 (World Bank, 2003). This was because the average income from informal sector jobs was insufficient to adequately meet livelihood demands (MFNP, 2003).

In short, since the early 1990s, the Zambian government has pursued a number of policies aimed at economic reform such as the liberalization and creation of a market economy. This has seen to the privatization of over 200 state owned enterprises and setting up of regulatory utilities to ease procedures for establishing business enterprises (ERB, 2002: 14).

4.3 Rationale for reforms in the energy sector

The first initiative at liberalizing the energy sector was the formation of a ministry responsible for energy in 1991 (ERB, 2002). Following this initiative, the government in 1994 formulated the National Energy Policy (NEP). The policy was formed to provide a sound basis for elaboration of plans and strategies that conform with the overall national development, as such dynamic and responsive to the dictates of the current situation, that is, the existing socio-economic and political environment. The main objective of the policy is to promote the optimum supply and utilization of energy especially local forms to facilitate the socio-economic development of the country and maintenance of a safe health environment (MEWD, 1994). Specific policies for each energy source are outlined in the NEP as summarized.

4.3.1 Woodfuel

Woodfuel in the form of firewood and charcoal are currently dominant sources of energy. The major objective of the NEP is to reduce dependence on woodfuel through the following measures:

- Ensure management and sustainability of the forest reserves for woodfuel harvesting.
- Improve the technology of charcoal production and utilization.
- Minimize seasonal fluctuation in the supply of charcoal to urban areas.
- Improve revenue collection from the woodfuel industry.

4.3.2 Petroleum

As the only energy source that is wholly imported in Zambia accounting for about 10% of the country's total national earnings, policy measures are aimed at the following:

- Ensuring security of supply of petroleum product and streamlining operations of the oil industry in order to increase efficiency through restructuring the market.
- Promoting petroleum exploration.

4.3.3 Coal

Coal is the third dominant naturally occurring source after woodfuel and electricity. NEP aims at promoting the role of coal in meeting energy demand of the country. Policy measures include:

- Promotion of the coal exploration.
- Promoting of the use of coal for industrial and commercial applications.
- To assess the feasibility of using coal in the household sector.
- To keep under active consideration of the use of coal for power generation
- Ensure that both coal mining and utilization have minimal environmental impact

4.3.4 New and renewable sources of energy

Although Zambia is endowed with New and Renewable Sources of Energy (NRSE) efforts to harness these resources have been minimal due to the following constraints:

a) Lack of awareness about NRSE technologies

b) High initial costs

c) Inadequate adaptive research of NRSE technologies to the Zambian situation

d) Lack of end user acceptability

e) Inadequate demonstration projects

f) Lack of specialized training

To address this situation policy measures are aimed to:

- Promote NRSE technological development.
- Promote wider application of NRSE technologies.
- Promote information dissemination about NRSE.
- Promote education and training NRSE at various levels.

4.3.5 Electricity

The electricity policy is aimed at increasing accessibility and developing the most cost effective sites for the domestic and export market. To attain this general goal the NEP outlines other specific policies in the electricity policy which include the following:

- The restructuring of the electricity industry in order to improve service delivery.
- Improve accessibility of electricity
- Promote electrification of productive areas and social institutions.
- Developing the hydro potential to take advantage of the strategic location in the sub region
- Review existing legislation on electricity in order to bring it in conformity with the current macro economic environment

To oversee the liberalization of the energy sector the Energy Regulation Board (ERB) was created under the Energy Regulation Act of April 1995. Through a number of

extensive consultations with stakeholders the ERB in line with its mandate proposed that the electricity market which is dominated by the state owned utility ZESCO be restructured in order for government to achieve its objectives outlined in the NEP.

According to the ERB (2002)' s proposal, the main objectives of restructuring the electricity market in Zambia include the increase of access to electricity by the majority of the Zambian population through expansion of the national electricity network to cover areas that have production potential.

The promotion of private sector participation in the electricity industry by ensuring that the structure of the electricity market and market rules are attractive to private investors; and the promotion of competition in the segments of the electricity market that are potentially competitive namely, generation and supply are the other major objectives of reform.

The reforms also aim to improve efficiency in the electricity industry (ERB, 2002).

4.4 Network expansion to rural areas

In the reformed electricity market ERB, recommends that an autonomous Rural Electrification Agency (REA) be formed for network expansion to rural areas. The REA should be responsible for mobilizing and coordinating funding, procuring contracts, monitoring implementation and evaluating performance of projects for rural electrification.

Governments role in REA should be the development of a policy framework in which it should operate and facilitating external funding for rural electrification. The

government also is expected to develop a master plan to serve as a guide for stakeholders for identifying projects to submit to the REA for funding. Projects for electrification should be demand driven by the participating stakeholders namely local communities, cooperatives, private investors, regional and local authorities.

The general guiding principle in the electrification programs should be the potential for industrial and commercial use of electricity. Household electrification is not given priority but is expected to take place through the trickle down effect as general incomes rise from the stimulated economic productive potential in the areas.

4.5 Institutions in the energy sector

4.5.1 ZESCO

An Act of parliament formed ZESCO in 1969. On its formation ZESCO took over electricity supply and distribution from various municipalities and three existing utilities. ZESCO got responsibility for energy planning and all power transmission and distribution with the exception of the Copperbelt. It is a para-statal company wholly owned by the government and operates within the framework of the state holding company, Zambia Industrial Marketing Company (ZIMCO) (AFREPREN, 1998). A Board of Directors sets ZESCO's corporate goals and objectives. The Minister of Energy individually appoints the Board Members; the chairman comes from the private sector. The President of the Republic appoints the Managing Director who is also the Chief Executive of the company (Kasanda, 2003).

Inadequate income has an effect on the maintenance and rehabilitation programs. The main causes of poor utility performance are aging plants, lack of maintenance and spare parts, low plant load factor and poor billing system. The financial performance of

the utility is deteriorating due to poor revenue collection, inadequate foreign exchange allocations, net exchange losses on the foreign loans, losses on rural operations and decline in exports.

The utility is in a position where it needs to stimulate demand in order to make use of its excess capacity in order to increase its revenue base. Reasons for low rate of domestic electrification are among others remoteness of houses from the existing distribution and supply line and the high connection fees and internal wiring costs.

ZESCO is responsible for implementation, operation and maintenance of the government's rural electrification projects. The Rural Electrification Fund (REF), which is 5% levy on all electricity bills, is remitted to the Ministry of Finance and National Planning (MFNP). However, very little is remitted back to ZESCO for the Rural Electrification Projects.

4.5.2 ZAMSIF

The Zambia Social Investment Fund (ZAMSIF) is one of government's poverty reduction instrument whose goal is to contribute to the improved, expanded and sustainable use of services in governance systems where the local governments and communities are mutually accountable.

ZAMSIF became effective in July 2000 under the MFNP as a successor to the Social Recovery Project.

The overall objective of ZAMSIF is to contribute to the government's strategy for poverty reduction by improving the welfare and the living condition of poor and vulnerable communities in all parts of Zambia.

ZAMSIF provides these marginalized communities with funds for basic services such as sanitation, education and health clinics. In providing some of these services ZAMSIF funds minor electrification usually solar based for the schools and clinics in conjunction with the Ministries of Education and Health. The numbers of solar installations were not provided in any of the documents collected.

ZAMSIF is supported by International Direct Aid (IDA) credit from The World Bank. The project has different phases and the current phase, Phase I is US$ 67.7 million. As at June 2000, ZAMSIF had funded 190 community projects from a range of sectors including Community Roads, Water and Sanitation, Education and Health (ZAMSIF, 2003).

4.5.3 ERB

The Energy Regulation Board (ERB) is the regulatory authority for the energy sector established under the energy regulation Act No. 16 of 1995. The ERB regulates undertakings in the energy sector that is, electricity, petroleum and new and renewable forms of energy through specialized licenses. All undertakings in the sector have to apply to the ERB. ERB is financed through these license fees, which consist of over 90% of its annual budget. However, grants from the government and international cooperating partners subsidize ERB (ERB, 2002). Among the international cooperating

partners is the Swedish International Development Agency (SIDA), which was also a significant contributor in developing ERB.

The ERB has a part-time Board for policy and regulatory decision-making and a full-time secretariat to assist the Board in carrying out its functions and for the day-to-day operations of the institution.

The Board made up of seven members is appointed by the Minister of Energy and Water Development among whom one is appointed as Chairman on a three year contract. The Board acts independently in its decision-making and prepares annual reports on its operations that are submitted to the Minister who in turn submits them to Parliament.

The Board is assisted by a secretariat with a staff establishment of 32 positions, though 23 at present, with various professional backgrounds and expertise such as management, engineering, chemistry, law, economics, public relations, finance and information technology amongst other disciplines.

4.5.4 MEWD

The Ministry of Energy and Water Development (MEWD) is the focal point of energy activities in the country. Its main roles are summarized as follows:

- To provide and articulate policy guidelines to the energy sector
- To develop and implement government energy policy
- To monitor developments in the energy sector

- To integrate energy sector into the national and regional development strategy
- To regularly review energy policy to bring it in line with developments in the sector and the economy as a whole

4.5.5 DoE

The Department of Energy (DoE) is part of MEWD. DoE consist of seven sections that is, energy information, economic analysis, new and renewable sources of energy, petroleum, coal and energy management, electrification, and administration. The major functions of DoE are as follows:

- To plan and insure that the rural electrification program is implemented efficiently.
- To monitor and advise on the implementation of the energy policy.
- To promote the development and wide utilization of NRSE technologies.
- To promote efficient management and conservation energy to promote substitution of indigenous energy for imported fuel sources.

According to past annual reports, the constraints of the department are the insufficient and untimely release of funds by the Ministry of Finance and National Planning. This causes the major hindrance to effective project implementation and operations of the department. Shortage of staff is another constraint (Karekezi and Kimani, 2002; Musonda, 2003).

4.5.6 UNZA

The University of Zambia (UNZA) is involved in training and research in the energy sector. The Energy and Environmental Physics Group at the Physics Department has

been the focal point of training the Energy Services Companies (ESCOs) technicians. It is also involved in running courses for ERB Inspectors in Solar Photovoltaic Technology. Currently, the Physics Department is involved in the PV project in the Eastern Province in conjunction with the Department of Energy and Stockholm Environment Institute. It serves as a testing center for the PV systems and training center for the PV technicians.

The Technology Development and Advisory Unit (TDAU) is an autonomous unit within UNZA that has been in operation since 1975.

It provides business services with the purpose of promoting income generations, employment and poverty alleviation within the Zambian economy and society. The focus areas of TDAU are consultancy and manufacturing. For instance, TDAU has been involved in the construction of micro-hydro plants in Mutanda in Northwestern province in Zambia as communicated in an interview held in April 2003 with Mr. Geofry Simukoko, Project Engineer at TDAU (Simukoko, 2003).

4.5.7 OPPPI

Office for Promoting Private Power Investment (OPPPI) was established within the MEWD in 1998. The office was created to facilitate private sector involvement in power development and to raise revenue in the national energy sector. The office was established to reduce the complexity of procedures, rules and regulations and the red tape usually associated with obtaining required approvals, permits and licenses by the private sector.

OPPI articulates and promotes the Framework and Package of Incentives and solicits and evaluates proposals, negotiates and processes the award of contracts and finalizes the Implementation and Power Purchase Agreements (IA and PPA) and Transmission Service Agreements (TSA). It designs, implements and manages the competitive process for procurement of private sector power and its associated infrastructure.

It promotes a framework and package of incentives, which include financing arrangement, fiscal incentives and procedures for applications and processing of proposals for hydropower generation projects.

The office interfaces with other agencies having primary responsibilities for key aspects of private power planning, procurement and operation such as ZESCO, ERB and Distribution Companies which may purchase power from Independent Power Producers (IPPs) as they acquire the capacity for direct power purchase.

The office plans to set up the Private Sector Infrastructure Development Fund (PSIDF) with the assistance of The World Bank and other multi-lateral lending agencies that may provide up to 30% of the capital costs. The PSIDF funding would be available for hydropower projects in form of Hydro Planning Funds. This fund will be available to both public and private sector. The aim of the fund will be to accelerate the pace of preparation of feasibility studies. The Hydro Planning Funds will be revolving; the fund will be reimbursed by the private sector on the award of the project.

The main focus of OPPPI is on larger hydro-plants that result in connection to the main grid. The office does not focus on small-scale power development projects, such as mini- hydros.

4.6 Summary

The main rationale behind the electricity industry reform is to increase access to electricity by the majority of people in the productive areas of Zambia. Rural household electrification is not viewed as being potentially economical.

In the existing institutions in the energy sector, none of them is solely responsible for rural electrification apart from the government whose programs are executed by ZESCO. Apart from this there is no other institutional arrangement under which rural electrification is addressed.

The planned establishment of REA, an agency dedicated to rural electrification could yield better results. REA could succeed provided that plans to provide electricity to both the urban and rural poor through the most appropriate least cost options exist. The options could include the affordable costs of connection fees and internal wiring for the poor, which do not currently exist. The existence of REA could also succeed provided that a comprehensive strategy is established. This strategy would include coordinated policies and programs through which rural electrification could carry off by means of local micro credit units.

5. POVERTY REDUCTION STRATEGIES IN THE ENERGY SECTOR

The Poverty Reduction Strategy Program (PRSP) is a basket of interventions aimed at reducing the current high poverty level in Zambia, which stands at 73%. The interventions cover the economic sector, social sector and infrastructure development to facilitate sustained economic growth and employment creation. Government in May 2002 endorsed the PRSP and the US $ 1,200 million program covers the period 2002 to 2004 (Grant Thornton, 2003:16).

Poverty reduction programs in the energy sector aim at increasing the current electricity access rate from 20% to 35% by 2010 with 15% being the rate for rural areas. The increased electrification levels are expected to enhance social and economic development by supporting agricultural activities in line with the NEP objectives. The increased access to electricity is expected to increase with electricity productive capacity, which will result in increased electricity exports, 300%, to neighboring countries by the year 2010.

As wood fuel still remains a major sources of energy for about 80% of the total population in Zambia, charcoal production programs have been aimed to reduce charcoal production by 400, 000 tonnes by 2010 through promotion of efficient production and utilization whilst encouraging fuel switch to higher forms of energy such as electricity, millennium gel fuel and liquid petroleum gas by low-income and medium income groups (MFNP, 2002b: 100).

Millennium gel is a renewable low cost cooking fuel. It is an ethanol-based fuel produced from byproducts of agricultural crops. Gel fuel as a fuel alternative to wood,

and so intended to slow deforestation (World Bank, 2002).

The PRSP therefore identifies three strategies of alleviating poverty in the energy sector as follows:

5.1 Enhancing the capacity of current energy delivery infrastructure through rehabilitation to ensure reliable and efficient supplies and access by more people.

Two projects to be undertaken in this strategy are the power rehabilitation and petroleum rehabilitation. The results expected are to expand the electricity coverage, promotion of alternative technology and steering energy use substitution to higher forms to uplift the living standards of low-income households. The projects are aimed at rehabilitating the power and petroleum infrastructure, which has been in use for more than 30 years without any major maintenance works.

5.1.1 Power Rehabilitation Project

The project started in 1995 after a series of technical audits on the major power infrastructure, which concluded that they were in need of major rehabilitation to bring them to the design operation level and extend their economic life span. The project has been in operation since 1998. The main components to be rehabilitated included the Victoria Falls, Kafue Gorge and Kariba North Bank, ZESCO Power transmission System, distribution networks of Lusaka, Ndola and Kitwe, reduction of losses in the Lusaka West Area, Gwembe–Tonga Rehabilitation and Development Program, ZESCO Institutional Strengthening and Hydropower Development and Transmission Line Policy. The total project is estimated to cost US$ 235 million and is funded through by a consortium lead by the International Development Agency (IDA),

European Investment Bank and the Development Bank of Southern Africa (DASA). Additional funds include grants from cooperating partners such as ZESCO and the government of Zambia especially to the financing of the Gwembe-Tonga Rehabilitation Project.

5.1.2 Petroleum Rehabilitation Project

The main components funded by this project were by IDA and the European Investment Bank. The project mainly involved the rehabilitation of the TAZAMA pipeline from Dar es Salaam in Tanzania to Ndola in Zambia including the tank farm in Dar es Salaam. Improved telecommunications and construction of a 40 000 ton capacity crude oil tank in Ndola and creation of a new technical cell on petroleum in MEWD are some of the activities.

Apart from rehabilitation, the government strategy includes exploring modalities for setting up strategic reserves of petroleum products and facilitating private sector participation in the procurement of feedstock for the refinery with the overriding goal of ensuring that petroleum products are supplied to the country at the least cost and utilized in the most efficient manner.

5.2 Creation of new energy delivery infrastructure.

These strategies aim at increasing domestic and export demands. According to the projections of power demand, the current installed capacity may be outstripped by the projected demand in the year 2005. In order to forestall power shortages the following projects were created.

5.2.1 Power Generation Projects

In order to forestall power shortages, an expansion of 600 MW is planned. The Kafue Gorge Lower Hydro Electric Scheme Project is located downstream of the existing 900 MW Kafue Gorge Upper Station. The project is estimated to cost US$ 430 million and will be led by private sector investment. The Itezhi Tezhi Hydro Electric Project upstream of Kafue Gorge Power Station has estimated capacity of 120 MW. It is expected to cost US$ 100 million. This project will require an additional US$ 28 million for the construction of a 200 km, 220 KV transmission line to the nearest point of interconnection, Muzuma, to the national grid.

5.2.2 Zambia- Tanzania Inter Connector Project

This project estimated at 153 million US $ involves the construction of a 700 km, 330 KV transmission line, 600 km on Zambian side and 100 km on Tanzanian side. The proposed line is expected to supply an estimated load of up to 200 MW. The scope of the project is to reinforce the Tanzanian system and exports to Kenya and beyond. This will be a private investor led project and hoped to include exports to Kenya and beyond.

5.2.3 Zambia Democratic Republic of Congo (DRC) Inter Connector Project

This is part of priority project in the SADC region master plan to transfer 1000 MW of power from DRC to South Africa and vice versa with a possibility of connecting the North-Western Province of Zambia to the grid. The project involves the construction of a 387 kV transmission line from Kolwezi in DRC to Luano in Zambia via Solwezi. Project costs are estimated US$ 120 million with the United States Trade and

Development Agency already having provided funds for pre-feasibility study on the Luano (Zambia)- Kansanshi (DRC) portion of the line.

The two regional interconnections could enable delivery of power surpluses from Zambia and other Southern African countries to the East Region.

CEC and ZESCO are already playing a major role in these inter connections. CEC wheels about 240 MW for ZESCO and 210 MW internationally from DRC. Currently CEC is working with partners from the DRC to increase capacity of the DRC-Zambia inter connector from the current 210 MW to 500 MW. This would be of benefit to the whole Southern African region as it would allow for additional power to be unleashed from the Inga Power Station in DRC. This development would also be beneficial to Zambia as a party to the Southern Africa Power Pool (SAPP) to have 80MW reserve power at any time (ESI, 2003:16).

5.2.4 Electrification of Mukushi Farm Block Project

This project that had been outstanding since the 1970s to unleash tremendous agricultural potential in the farming block was only partly electrified by ZESCO through 33 KV line. A contract was awarded to Nampower of Namibia to supply electricity to the farming block. The projects estimated cost is US $ 40 million.

5.2.5 Promotion of efficient production and utilization of woodfuel

The overall goal is to reduce the use of woodfuel and once fully operational envisaged to result into wood saving of 10% of total wood consumption equivalent to 400 thousand tons per annum. Projects in this regard include awareness programs through practical manuals on charcoal production that can assist rural communities increase

their production efficiency in the earth kilns and use efficiency through adoption of improved stoves.

Substitution of charcoal in urban households with millennium gel-fuel and liquid petroleum gas is another strategy. The gel will either be imported from Zimbabwe or Malawi or produced in Zambia at the Nakambala Sugar Estate where production of ethanol from molasses already exists (MFNP, 2002b: 102).

5.2.6 Rural electrification program

To make the rural electrification fund more effective, the government will create a conducive environment for the development of a national Rural Electrification Master Plan (REMP). The REMP will identify options for electrification at least cost; review and improve the administration of the already existing rural electrification fund raised from a 5% levy on all electricity bills. Further the REMP will work towards the integration and use of NRSE in the provision of energy services to the rural communities.

Prominent among these NRSE services are solar and mini and micro hydros. The DoE is currently implementing a pilot study with solar home systems in Eastern Province of Zambia. Micro hydros are estimated to be installed at 200 US$ per household. With a target of 500 households a budget of US$ 100 000 will be required (MFNP, 2002b: 103). A UNIDO-GEF project is currently underway in the North-Western Province to this effect. The project is in its prefeasibility study phase (Section 3.7).

As at now grid extension remains an important aspect of the rural electrification program.

5.3 Targeted interventions aimed at achieving particular results such as increased access and promotion of alternative technology.

The PRSP does not however give any specific activities as to how targeted interventions would be implemented.

5.4 Budget allocation to energy PRSP

The government made a provision of K 420.7 billion (87.6 million US $), 2.2% GDP to poverty reduction programs of which K 179.9 billion (37.4 million US $), 43% is expected to be financed by a grant from the European Union. The current 2003 budget does not specify incentives for the energy sector in order to attract private investment. Outside the budget however government disclosed that major power generation project like the Kafue Gorge Expansion Project would be funded by international lending institutions namely the World Bank (Grant Thornton, 2003: 30). Excise duty on diesel and electricity remained unchanged.

The rural electrification program was to continue and K5 billion had been proposed under poverty reduction but K100 billion would be needed to complete the program. In the petroleum sub sector government would still continue to maintain strategic reserves at the Indeni storage tanks in Ndola (Grant Thornton, 2003:30).

Incentives for various sectors such as tourism, agriculture and non-traditional mining were made by government with specific incentives to attract private investment. In the tourism sector for instance, K5 billion was allocated to the development of a Tourism Credit Facility. This facility is expected to encourage Zambians to invest in tourist ventures. In addition K9.6 billion was allocated to the marketing and development of tourism infrastructure such as national parks as means of alleviating poverty. However, growth in these sectors will only be possible with an increase in electricity usage from the current levels. Energy is a vehicle of development.

5.5 Summary

The poverty reduction strategies are aimed at improving macro projects on a national level. These strategies could ultimately achieve economic growth, whose benefit could be shared even by the poor. However, their possible disregard of social institutional framework could worsen the level of poverty, whilst their focus would be on the efficiency of macro development projects. Furthermore, in the event of economic growth, budget elasticities indicate the possible increased demand for traditional fuels by the poor in the absence of supporting mechanisms to assist them access modern energy sources (Kabede, 2002).

The main goal of the regional interconnection projects is to strategically place Zambia at the centers of inter connector lines between Southern Africa and East Africa and other countries beyond. These connection lines are beneficial to the African region in accessing the potential 39 000 MW of the Grand Inga scheme. The development of Inga is tied to multi-regional, environmental and social friendly development program driven by commercial and industrial demand for clean energy. Therefore any

development towards this hydro potential in DRC makes huge economic sense for Zambia (ESI, 2003:20).

Strategies to reduce or promote efficient use of lower forms of energy such as wood and charcoal are included in the poverty reduction strategies. These strategies focus on awareness programs and fuel substitution. Strategies to assist low-income households get affordable access to the suggested fuels such as LPG or millennium gel are not mentioned. Furthermore fuel substitution means additional costs of the use of new appliances imposing an additional economic burden on poor households.

The budget allocation indicates the degree of governments' financial commitment to developing rural electrification. Only 5% of funds needed for poverty reduction strategies are allocated which may altogether not be remitted as experienced in the past (MEWD, 2000b). The usual REF program that actually targets economically viable communities is to continue.

The rationale behind reforming the electricity industry is to open up the market to private investors, both local and international. The incentives to attract them into the energy sector are planned for but not accounted for in the budget.

6. DISCUSSION

Electricity is indeed a catalyst of development as noted in the development of agricultural and tourism industries in Zambia. For instance the Mpongwe Rural Electrification Project in the mining town of Ndola and the Siavonga and Luanwga National Park electrification resulted into tremendous growth in the agricultural and tourism industries respectively (AFREPREN, 1992:29). However the trickle down effect that was expected to take place to create demand from the poor households did not take place. This indicates that it is essential that a household energy policy particularly one aimed at poor households must address all supply and demand side options. (Eberhard and van Horen, 1995:151).

6.1 Electrification programs/ poverty reduction strategies

The electrification programs are not targeted at creating affordable access to the poor household but are focused on macro projects, which are expected to result into economic growth effectively filtering the basic need of electricity down to the poor. This has been the way in the past, which has not worked. No deliberate move is made in these programs to identify the end users' needs who are usually very willing to pay for the service in one way or another. One way to improve this is to have government covering part of the capital cost of the ready board and internal wiring. The electrification of low-income household project carried out in Pamodzi Townships demonstrated that when more attention is given to the needs of the consumers the utility could be rewarded by achieving sustainable electrification projects and more so improve the livelihoods of the poor people (Arvidson and Enders, 1998).

6.2 National energy policy

The NEP does not specify any direct strategies of assisting the poor in getting any affordable access to electricity. The government can however improve the situation by providing lifelines to these remote areas to assist them in making the areas economically viable. The continued targeting of communities in the urban areas or those willing to pay in terms of spatial location of incomes will miss out on the people who are willing to pay for the service in these poor areas. The mere provision of the service to the poor at no cost could be detrimental to the electricity companies. Electrification may be the most cost effective supply option but poor households are less likely to be able to afford not only the connection and internal wiring but also the cost of new appliances to use the resource (Eberhard and van Horen, 1995:152).

6.3 Rationale for power sector reforms

The reformed electricity industry is expected to increase electrification to the poor through the private sector and the creation of REA. To leave the issue of social benefits entirely to private investors could be detrimental to the poor. The case of Quebec clearly indicates the danger of high tariffs. Without considerable attention to means of affordable access to electricity by the poor at the inception of the reforms, addressing them at a later stage could be an uphill battle. To be effective, social concerns need to be included into the reform design early and backed by strong political commitment. (WRI, 2002). The example of Argentina shows how this can be detrimental to low-income groups if not factored early in the design. Private utilities will not extend networks were it is unprofitable, unless government subsidies make up for the financial losses and provide a fair margin of profit (IEA, 2002; Pineau, 2002).

6.4 Budget allocation to rural electrification

The budget allocation to rural electrification is very low and often lacking from government despite the existence of the REF (Tables 6.1 and 6.2). The budget allocation of 5 billion Kwacha (1.04 million US $) for 100 billion Kwacha (20.8 million US $) projects simply indicates that electrification of rural areas still have low priority compared with other electrification projects.

Table 6.1 Budget and actual releases of funds for rural electrification projects

Project	1993 (US $'000)		1994 (US $'000)		1995 (US $'000)	
	Budget	Released	Budget	Released	Budget	Released
Mkushi Farming Block	2.208	0	167.3	0	4.628	1.735
Chipata-Lundazi Power Line	2.208	0	83.66	0	64.79	0
Chilubi Island Boma	114.84	0	89.63	0	71.73	0
Chama Boma	172.26	0	89.63	0	71.73	0
Nyimba and Kachalola	37.54	0	55.27	0	41.65	0
Kalichelo, Feni and Chiparambai	66.25	110.42	55.27	0	41.65	0
Mulobezi	19.88	0	55.27	0	45.12	0
Chibuye Rural Health Centre	75.09	66.25	67.22	0	53.38	0
Siavonga Reinforcement	2.208	0	110.55	0	78.68	0
Rural Electricity Installations	2.208	0	5.98	0	157.35	0
Mambwe, Jumbe	8.83	0	16.43	0	12.73	0
Senga Hill	37.54	0	32.86	16.43	25.45	0

Source: (MEWD, 2002)

For electrification to be affordable by the poor, the government has to take the lead role. The case of China provides a good example of such leadership were government mobilized the local resources for this purpose (IEA, 2002). The example of China shows that focused poverty alleviation electrification programs can be successful if fully backed by strong commitment from government. In two decades China was able to secure electricity access for almost 700 million people to levels as high as 98% amidst poverty levels of 56%. The key success was the central governments determination and its ability to mobilize contributions at local level, backed with subsidies and low interest loans (IEA, 2002:14).

Table 6.2: Amounts of funds released towards rural electrification from REF

Year	Amount	Year	Amount
1994	937,588,808	1997	0
1995	2,479,879,463	1998	600,000,000
1996	0	1999	1,000,000,000

The total amount released since 1994 is slightly above K5 billion.

Source: (MEWD, 2002)

There have been times however in Zambia when tremendous pressure from political leadership at provincial council level has sought funds from government to invest in rural electrification. Most of these pressures have ended up as government future development plans (AFREPREN, 1992: 30). In other instances ZESCO had to connect and supply electricity to some rural areas under such political pressures without any upfront connection fees.

The costs of new electrical appliances, connection and internal wiring are still the major constraints to affordable access to electricity by the poor households. Therefore budget allocation in form of revolving funds towards the acquisition of appliances and connection fees could provide incentives to private investment in rural electrification.

7. CONCLUSION

7.1 Conclusion

The key findings in this study show that there are no initiatives in Zambia that address the problem of affordable access of electricity by the poor households in Zambia. Further the proposed approach to restructure the electricity industry in Zambia does not contain any specific initiatives for affordable access to electricity to the poor households. The ultimate result in power sector reforms may eventually leave the role of rural electrification in the hands of the private sector but from international experiences this has worked against this social concern (Pineau, 2002).

Another key finding in this study is that if any improvement in rural electrification has to occur, a clear change has to be made regarding the energy policies and political commitment.

Rural electrification is constrained by lack of funds and when funds are available they are distributed according to different priorities under which rural electrification is at the bottom of the list. The untimely release of adequate funds by the MFNP hampers rural electrification (Tables 6.1 & 6.2). The total amount released over a five-year period from 1994 to 1999 was approximately 5 billion Kwacha (1.04 million US $) and a similar amount was allocated for future electrification programs estimated to cost 100 billion Kwacha (20.8 million US $) in the 2003 national budget (Grant Thornton, 2003).

The use of lower forms of energy is very attractive for the poor given that they are not only affordable and genuinely subsidized in the sense that government foregoes their revenue but also within easy access given the abundance of the resources. Many rural areas still have the access to natural woodland, which is generally free to harvest but bears a heavy social burden in terms of cost in time and effort for collection (Eberhard and van Horen, 1995:152). However, these resources are also vastly diminishing, as the woodlands are fast disappearing (Kalumiana, 2000). The use of charcoal and firewood will continue to serve as alternative sources of energy for the poor. Unless future plans to improve the efficient use of these energy resources, charcoal and firewood; or their substitution are supported by an institutional framework with adequate funding to meet their affordable use by poor households. Furthermore fuel substitution means additional costs not only of the fuel source but the purchase of the new appliances imposing additional economic burdens on poor households. The Pamodzi Low Cost Electrification Project (Section 3.5) shows how deferred payment systems in fuel substitution can work.

The current rural electrification programs and the poverty reduction strategies electrification programs do not address the need of affordable access of electricity by the poor. The long-standing issues, which hamper access of electricity by the poor such as the high costs of internal wiring, still remain their sole responsibility. The electrification guidelines specify that only communities that demonstrate practical willingness to meet the cost of internal wiring of their houses or buildings or purchase of ready boards will be given preference in terms of funds from the Rural Electrification Fund by government (MEWD, 1995). The poverty reduction strategies

aim to improve macro electrification projects. The economic benefits ensuing from these projects are expected to trickle down to the poor. However in the event of economic growth, budget elasticities indicate the possible increased demand for traditional fuels by the poor in the absence of supporting mechanisms to assist them access modern energy sources such as electricity (Kabede, 2002).

The World Bank policy of conditioning loans on institutional restructuring has provided further impetus to reform in Zambia. The approach to restructuring the electricity industry will influence important social concerns such as access to price, quality of service and labor impacts (WRI, 2002). If the reforms are targeted at leaving the electricity supply industry entirely in private hands, there exists a danger of compromising the broader national agendas such as affordable access to electricity by the poor. The motive of multinational companies is to make profit (Pineau, 2002). The problems of market forces in the case of Quebec indicate how the low-income groups could be further subjected to high tariffs when the electricity industry is entirely under private ownership (Section 2.2).

The case of South Africa for instance provides an example of how reforms can be driving broader national agendas. Instead of reforms being spurred by financial crisis in the economy, the public utility Eskom was the important political actor. Eskom was central in the discussions about whether the national broader agenda, access to electricity and black empowerment would be better served through the existing system or by a restructured power sector. The national government therefore was able to exercise considerable control over reforms and framed them around social issues

resulting in high rates of access to electricity, 70% (WRI, 2002:4).

The government therefore clearly has an unavoidable role in providing affordable access of electricity for the poor households and in intervening to mitigate the use of other household fuels such as paraffin and charcoal (Eberhard and van Horen, 1995: 207). The case of South Korea who's major source of energy until 1965 was firewood and China show that it is possible for government to provide affordable access to electricity to the majority, especially the poor. Such objectives are achievable if backed by strong political will and the mobilization of resources is directed by the government.

7.2 Recommendations

The following are general recommendations on the energy policy and rural electrification strategies:

- The planned power sector reforms in Zambia should include strategies that focus on social concerns that assist the poor at the highest level of the reforms process. These could include strategies that focus on the distribution end of the electricity industry.

- Review the energy institutional structure by establishing a section solely responsible for rural electrification within the DoE in the short term. This section could act as a central data bank and authority in rural electrification, especially in paving way and drawing guidelines for REA. The creation of REA is a long-term project and could be a success provided that strong poltical will and adequate funding back it.

- Since grid extension remains the main means of rural electrification further focus could be on creating a number of subsidiary regional grids serving different provincial centers and surrounding areas since all the 72 District Administrative centers are electrified. Better use of local management skills could achieve significant performance improvements at low cost.
- The issue of tariffs will continue to be subject to debate, but the tariffs structure has to be reviewed in order to benefit the poor households. The centrality of the tariff question reflects the importance of end-user, poor households to the power sector reform process (Mangwengwende, 2002: 947). In this case the problem of connection fees and internal wiring which hinder access to electricity by poor households.

7.3 Suggestions for further studies

Investigate appropriate mechanisms in increasing affordable access to electricity by poor households in Zambia.

REFERENCES

African Energy Policy Research Network (AFREPREN) (1998). Lucy Kahlema-Redeby, Hailu Mariam, Abel Mbewe & Ben Ramasedi, *Planning & Management in the African Power Sector.* Nairobi: AFREPREN.

African Energy Policy Research Network (AFREPREN) (1996). G Elfaki All, I A R Elgizouli, B A Okech & P M Nyoike, *Energy Utilities and Instructions in Africa.* Nairobi: AFREPREN.

African Energy Policy Research Network (AFREPREN) (1992). Abel Mbewe, Hailu G. Mariam, Ben Ramasedi, Lucy Khalema & Isse All Ahmed, *Rural Electrification in Africa.* Nairobi: AFREPREN.

Arvidson, A. & Enders E. (1998). *Electrification of low-income households in developing countries: Experiences from a pilot project in Ndola, Zambia*. Stockholm: Stockholm Environment Institute.

Central Statistical Office (CSO) (2000). *Living Conditions in Zambia – 1998* Lusaka: Central Statistical Office.

Chiinda, S. (2003). Manager-Research Economic & Financial Analysis of Energy Regulation Board. Interview held in April 2003. Lusaka.

Clark, Martin and Marks, Jon (1999). *African Power Projects.* London: Financial Times Energy.

Eberhard, A and van Horen, C (1995). *Poverty and Power: Energy and the South African State.* London: Pluto Press.

Electricity Supply Industry (ESI) (2003). "Copperbelt Energy Corporation-A Regional Example" in *ESI Africa.* issue 4:13-17

Energy Regulation Board (ERB) (2002*). Restructuring the Electricity Market in Zambia: Proposal to the Ministry of Energy and Water Development*. Lusaka: ERB.

Engurait, S.P. (2001). *Energy Sector Reform Theme Group: Data and Statistics Compilations-Uganda*. Nairobi: AFREPREN

Environmental Council of Zambia (ECZ). (2001). *State of Environment in Zambia 2000.* Lusaka: Norwegian Agency for Development Cooperation.

Grant Thornton (2003). *Budget Bulletin Year 2003.* Lusaka: Grant Thornton.

International Energy Agency (IEA) (2002). *Energy and Poverty.* USA: International Energy Agency.

Jain, Prem C. (2003a). *National Consultant Report: Renewable Energy-Based Electricity Generation for Isolated Mini-Grids in Zambia*. Lusaka: The University of Zambia.

Jain, Prem C. (2003b). Energy and Environmental Physics Group, Physics Department, Interview held in April 2003. Lusaka: UNZA.

Kabede, Bereket (2002). "Can the urban poor afford modern energy? The case of Ethiopia" in *Energy Policy 30:*1029-1045.

Kalumiana, O.S. (2003). Deputy Director of Department of Energy. Interview held in March – April 2003. Lusaka: DoE.

Kalumiana, O.S. (2002). *Energy Services for the Urban Poor in Zambia.* Lusaka:African Energy Policy Research Network.

Kalumiana, O.S. (2000). *Charcoal Potential in Africa- Zambian Study Component.* Lusaka: 2000 Progress Report.

Karekezi, Stephen and Kimani, John (2002). "Status of power sector reform in Africa: impact on the poor" in *Energy Policy 30*: 923-945.

Kasanda, K. (2003). Chief Economist of Zambia Electricity Supply Corporation

(ZESCO) Headquarters. Interview held in April 2003. Lusaka: ZESCO.

Kyokutamba, J. (2001). *Energy Services for the Urban Poor in Uganda.* Nairobi:AFREPREN.

Mangwengwende, S.E. (2002). "Tariffs and subsidies in Zimbabwe's reforming electricity industry: steering a utility through turbulent times" in *Energy Policy 30*: 947-958

Mbewe, A. (2001). *Country Data and Statistics-Zambia.* Nairobi: AFREPREN.

Ministry of Energy and Water Development (MEWD) (2002). *Mechanism For Expanding Rural Electrification Through: Solar Photovoltaic Energy Service Compnies (PV-ESCOS).* Lusaka: Department of Energy.

Ministry of Energy and Water Development (MEWD) (2000a). *Energy Statistics Bulletin 1980-1999.* Lusaka: Department of Energy.

Ministry of Energy and Water Development (MEWD) (2000b). "Ministerial Statement on Rural Electrification" a paper submitted to the National Assembly. Lusaka: Department of Energy.

Ministry of Energy and Water Development (MEWD) (1995). *Guidelines on Selection of Rural Electrification Projects for Funding by Government.* Lusaka: Rural Electrification Fund Committee.

Ministry of Energy and Water Development (MEWD) (1994). *National Energy Policy.* Lusaka: Department of Energy.

Ministry of Finance and Economic Development (MFED) (1999). *Macroeconomic Indicators April 1999.* Lusaka: Directorate of Macroeconomic Policy Analysis.

Ministry of Finance and National Planning (MFNP) (2003). *Economic Report 2002.* Lusaka: MFNP.

Ministry of Finance and National Planning (MFNP) (2002a). *Transitional National*

Development Plan: 2002-2005. Lusaka: Planning and Economic Management Department.

Ministry of Finance and National Planning (MFNP) (2002b). *Zambia Poverty Reduction Strategy Paper: 2002-2004*. Lusaka: Planning and Economic Management Department.

Musonda, Geoffrey (2003). Mechanical Engineer of Department of Energy, Interview held in April 2003. Lusaka: DoE

National Electricity Regulator (NER) (2001). *National Electricity Regulator Annual Report 2000/2001*. Sandton: NER.

Nyirenda, L.D. (2003). Project coordinator of Renewable Energy Promotion through Information and Communication Technology Introduction in Off-grid Rural Communities. Interview held in April 2003. Lusaka: UNIDO-GEF.

Pineau, Pierre-Olivier (2002). "Electricity sector reform in Cameroon: is privatisation the solution?" in *Energy Policy 30:*999-1012.

Sichone, E. (2003). Project Coordinator of Renewable Energy-based Electricity Generation for Isolated Mini-grids in Zambia. Interview held in April 2003. Lusaka: UNIDO-GEF.

Simukoko, Geofry (2003). Project Engineer at Technology Development and Advisory Unit (TDAU). Interview held in April 2003. Lusaka: UNZA.

United Nations Development Programme (UNDP) (1998). *Zambia Human Development Report 1998*. Lusaka: UNDP

United National Industrial Development Organization (UNIDO) (2003). *Global Environment Facility: Proposed Concept and Request for PDF Block B Grant*. Lusaka: UNIDO.

World Atlas (2004). Map of Zambia. http://www.WorldAtlas.com & http://www.lib.utexas.edu/maps/africa.html#Z

World Bank (2003). http://www.poverty.worldbank.org.files.Zambia:20/prsp.pdf. December 2003.

World Bank (2002). "An African Vision: Millennium Gelfuel, Gasoline Gelfuel & Gasoline-Ethanol Blending Ethanol Blending", World Bank internal reports at Biomass Energy workshop and exhibition, February. Washington: World Bank.

World Bank (2001). *World Development Report 2000/2001*. Washington: World Bank.

World Resources Institute (WRI) (2002). *Power Politics: Equity and Environment in Electricity Reform.* (ed) Navroz K. Dubash. Washington: WRI.

Zambia Electricity Supply Corporation (ZESCO) (2004). "Geographical location of Zambia in Africa" in http://www.zesco.co.zm/bis-project-site-fig2.html

Zambia Electricity Supply Corporation (ZESCO) (2001). "ZESCO Limited Revision of Electricity Tariffs". ZESCO internal reports. Lusaka: ZESCO.

Zambia Electricity Supply Corporation (ZESCO) (1999a). *ZESCO Annual Report 1998/1999.* Lusaka: ZESCO.

Zambia Electricity Supply Corporation (ZESCO) (1999b). *ZESCO Electricity Tariff Study: Swedpower Final Report.* Lusaka: ZESCO.

Zambia Social Investment Fund (ZAMSIF) (2003). ZAMSIF News. Lusaka. ZAMSIF.

LIST OF INTERVIEWS

Department of Energy, MEWD, Lusaka

Mr. Oscar S. Kalumiana, Deputy Director, March-April 2003

Mr. Geoffrey Musonda, Mechanical Engineer, April 2003

Ms. Musonda Sinkala, April 2003

Energy Regulation Board

Mr. Shantebe Chiinda, Manager- Research Economic & Financial Analysis, April 2003

Mr. George Mubipe, Manager-Finance & Administration, April 2003

Mr. Kenneth O. Kangende, Acting Manager- Technical, April 2003

Ms. Agnes Banda, Consumer Affairs Manager, April 2003

ZESCO (Zambia Electricity Supply Corporation)

Mr. Alex Mabuku Matale, Director Distribution & Supply Directorate, April 2003

Mr. Kasanda, Chief Economist, April 2003

ZAMSIF (Zambia Social Investment Fund)

Mr. Sydney L. Chama, Programme Officer – Field Operations, April 2003

UNZA (University of Zambia)

Prof. Preem Jain, Energy and Environmental Physics Group, Physics Department, April 2003

Dr. Tamba Tamba, Head of Technology Development and Advisory Unit (TDAU), April 2003.

Mr. Geofry Simukoko, Project Engineer at TDAU, April 2003

Mr. Emmanuel Matsika, School of Engineering, April 2003

OPPPI (Office for Promoting Private Power Investment)

Mr. Israel Phiri, April 2003

UNIDO-GEF (United Nations Industrial Development Organization-Global Environment Facility)

Mr. Elijah Sichone, Project coordinator of Renewable Energy-based Electricity Generation for Isolated Mini-grids in Zambia, April 2003

Dr. L.D. Nyirenda, Project coordinator of Renewable Energy Promotion through Information and Communication Technology Introduction in Off-grid Rural Communities, April 2003

SEMI STRUCTURED QUESTIONNAIRE

Questionnaire Structure……

Name of Interviewee……

Designation……...…

Institution……..

Date……

Contact details……

1. What is the main role of institution in energy sector?
2. Who should take responsibility for electrification programs and why?
3. Who should monitor and evaluate the electrification programs?
4. How can the private sector be encouraged to participate in rural electrification programs?
5. Will power sector reform alone enable increased access to electricity by the poor?
6. If tariffs must rise as a result of reform, what can government do to protect the poor?
7. In case of subsidies to the poor, how can tariffs be structured so as to genuinely benefit the poor?
8. What is the best way to fund public benefits?

LIST OF TABLES

LIST OF FIGURES